

Source Control Evaluation Time Oil Northwest Terminal Portland, Oregon

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Prepared for

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1.0 INTRODUCTION

This report presents the results of the source control evaluation conducted for the Time Oil Co. (Time Oil) Northwest Terminal (Terminal), located in Portland, Oregon (Figure 1). Activities at the Terminal are currently conducted in accordance with the State of Oregon's Hazardous Substance Remedial Action Rules (OAR 340-122), under the oversight of the Oregon Department of Environmental Quality (DEQ) and under the voluntary cleanup program (VCP) agreement between Time Oil and DEQ, dated September 9, 1996 (DEQ No. WMCVC-NWR-96-07; DEQ 1996). The source control evaluation was conducted in accordance with the Final Portland Harbor Joint Source Control Strategy (JSCS; EPA and DEQ 2005). The data included in the Phase III remedial investigation report (RI; Landau Associates 2005a) and data collected during subsequent groundwater monitoring events were used as a basis for the evaluation.

1.1 PURPOSE

Overall, the purpose of the source control evaluation was to determine whether or not the facility as a whole is an ongoing source of contaminants of interest (COIs) to the in-water portion of the Portland Harbor Superfund site at levels that may present risk to in-water receptors. Based upon data collected during completion of the Phase III RI, this source control evaluation considers all known potential contaminant migration pathways to the river. The evaluation identifies where complete physical transport pathways to the river exist and whether these pathways represent current complete contaminant migration pathways. The evaluation also includes how contaminant migration pathways are addressed through previous or currently ongoing source control actions. The source control evaluation also provides the screening results comparing groundwater concentrations in the shoreline wells against the screening level values (SLVs) from the Table 3-1 of the JSCS and our recommendations for any future actions related to source control at the Terminal. Based on groundwater concentrations observed to date in shoreline wells along the Willamette River, Time Oil has thus far demonstrated there is not a complete contaminant migration pathway to the river at concentrations that exceed the JSCS SLVs, as will be supported by the contents of this report. The lack of a current complete contaminant migration pathway to the river is due in part to the successful implementation of the groundwater interim action system and storm drain intercept system for groundwater contamination associated with the historical wood treatment product formulation operations.

A more specific objective of the source control evaluation was to evaluate the potential for an upland petroleum hydrocarbon source to impact the Willamette River. A portion of the source control evaluation focuses on the potential for natural attenuation to limit migration of light non-aqueous phase

liquid (LNAPL) from the Main Terminal Tank Farm area to the river using monitored natural attenuation (MNA) parameter measurements and a fate and transport model that takes into account the effects of natural attenuation, including both LNAPL mobility and dissolved-phase mobility. A plan for the MNA evaluation was provided to DEQ on September 15, 2005 (Landau Associates 2005b) and approved by DEQ in a letter, dated October 11, 2005 (DEQ 2005a).

1.2 REPORT ORGANIZATION

This report is organized into the following sections:

- **Section 2.0 Background Information.** This section provides a description of the facility and its history, as well as potential onsite sources of contamination.
- **Section 3.0 Potential Migration Pathways.** This section provides a description of the physical transport pathways and potential contaminant migration pathways to the river from impacted media onsite.
- **Section 4.0 Summary of Source Control/Removal Activities.** This section provides a description of ongoing source control and source removal activities, as well as completed source control and source removal activities conducted onsite to date.
- **Section 5.0 Preliminary Screening Evaluation for COIs.** This section provides the contaminant screening criteria used for comparison to site-specific contaminant concentrations and the results of the screening process in accordance with the JSCS.
- **Section 6.0 Conclusions and Recommendations.** This section provides our conclusions on whether complete contaminant migration pathways exist for each of the potential migration pathways using the comparison to JSCS SLVs and other weight-of-evidence information.
- **Section 7.0 Use of This Report.**
- **Section 8.0 References.**
- **Appendix A: Monitored Natural Attenuation Evaluation.** This appendix provides a description of the monitored natural attenuation evaluation, including an evaluation of the MNA parameter measurements and the results of the fate and transport modeling.

2.0 BACKGROUND

This section provides background information for the Terminal for use in making a source control decision under the JSCS. Specifically, this section provides a general description of the Terminal and its operational history, potential sources of contamination at the Terminal, and associated upland contaminants of interest.

2.1 SITE DESCRIPTION AND HISTORY

The Northwest Terminal is a former bulk petroleum storage and transfer facility currently owned by Time Oil. Time Oil ceased operations at the Terminal on October 31, 2001. From 1943 to 2001, the Terminal was operated by Time Oil as the Northwest Terminal petroleum products facility. Since operations began, the Terminal was used for the receipt, storage, and distribution of petroleum and petroleum-related products. Historically, Time Oil leased tank space to Crosby & Overton for storage of waste oils, and the Koppers Company leased and owned tanks and equipment at the Terminal for the formulation and blending of pentachlorophenol (PCP)-containing wood treatment products.

The facility is located in Township 2 North, Range 1 West, Sections 34 and 35, in the industrialized Rivergate area of north Portland, Oregon (Figure 1). The Terminal is bordered to the east and south by heavy industrial complexes, to the north by heavy industrial property and Port of Portland undeveloped property, and to the west by the Willamette River. The Terminal is approximately 52 acres in size and is generally flat with an average land surface elevation of about 28 ft above mean sea level (MSL). The Terminal is enclosed by a terminal-wide chain link fence, and access is through the main gate at the termination of Time Oil Road. Significant site features are shown on Figure 2.

2.1.1 FORMER PCP MIXING AREA AND WAREHOUSE

In the former PCP mixing area and warehouse area, specialty wood treating products containing PCP in various formulations (typically with petroleum-based carriers) were blended and stored for offsite shipment from 1967 to 1984 under an agreement with the Koppers Company Inc., (n/k/a Beazer East, Inc). The former PCP mixing area was located in the approximate center of the Terminal, and included the former PCP warehouse and the area south of the warehouse (formerly occupied by various mixing and storage tanks that were removed by 1982; Figure 2). During September through November 2002, soil removal action activities were conducted within the former PCP mixing area and associated areas. These activities included the demolition of the former PCP warehouse and the excavation of approximately 6,400 yd³ of PCP-impacted soil from the former PCP mixing area. The excavation area and remaining PCP concentrations in soil are shown on Figure 4. Also, as part of this removal action, approximately

2,400 yd³ of PCP-impacted soil, which was excavated from the former PCP mixing area in 1989 and stockpiled in the former stockpile area or was transferred from the East Property during interim removal actions in 1996-97, were also removed. Therefore, a total of approximately 8,800 yd³ (9,700 tons) of PCP-impacted soil associated with this source area were removed for offsite incineration and disposal at the Swan Hills facility in Alberta, Canada. Removal activities are documented in the Removal Actions Completion Report, Phases I/II RI Areas (Landau Associates 2003a).

2.1.2 FORMER MAIN TANK FARM AREA AND ASSOCIATED PETROLEUM OPERATIONS

Various petroleum products were stored and handled in the former Main Terminal Tank Farm area located on the western portion of the facility, adjacent to the Willamette River (Figure 2). The Main Terminal Tank Farm area includes 21 aboveground storage tanks (ASTs), ranging from approximately 3,000 to 80,000 barrels (i.e., 126,000 to 3,360,000 gallons) in capacity. In 1943 when the Terminal was first established, 12 of the original tanks were moved to the Main Terminal Tank Farm area from a location south of the current property. Between the mid to late 1950s and 1970s, additional tanks were added in the Main Terminal Tank Farm area bringing the area to the current configuration. Currently, all tanks are empty except for tank 16804 in the Main Terminal Tank Farm area, which temporarily stores recovered water from groundwater interim action wells RW-2 and HRW-1, and water collected from the groundwater intercept system in the east-west trending storm drain at SDM-1, prior to treatment at the onsite wastewater treatment system.

2.1.3 FORMER BELL TERMINAL TANK FARM AREA AND ASSOCIATED PETROLEUM OPERATIONS

Various petroleum products were stored and handled in the Bell Terminal Tank Farm area located on the southern portion of the facility. The Bell Terminal Tank Farm area was first established in the late 1940s to early 1950s. Currently, the Bell Terminal includes 10 ASTs ranging from 3,000 to 80,000 barrels in capacity. All tanks are empty.

In September 2001, a 5,000-gallon fiberglass underground storage tank (UST) was removed from an area to the east of the office at the Bell Terminal Tank Farm area. Approximately 43 tons of diesel-impacted soil was removed from the tank excavation and treated and disposed at the TPS Technologies facility, formerly located in Portland. Analytical results for confirmation soil samples collected at the base and sides of the excavation indicate that petroleum constituents were not detected or were less than 500 mg/kg (the DEQ Level 2 Soil Matrix Cleanup Standard for diesel- and heavy oil-range hydrocarbons). Documentation of the UST removal is provided in the Report of UST Removal Site Assessment (GeoEngineers 2001). Also at the Bell Terminal Tank Farm area, historical aerial

photographs indicate that a strip of land approximately 80 ft wide along the entire western property boundary and outside the wall surrounding the Bell Terminal Tank Farm area was apparently used by occupants of the adjacent property for storage of equipment and possibly other unknown activities for approximately 25 years, ending in about 2000. No specific spills or leaks in the Bell Terminal Tank Farm area or along the western property boundary of the Bell Terminal have been reported.

2.1.4 FORMER CROSBY & OVERTON TANK AREA

The former Crosby & Overton Tank area was located directly south of the former PCP mixing area where waste oils were previously stored in two ASTs from 1974 to 1989 through a lease to Crosby & Overton. The tanks have since been removed from this area. Another AST (Tank 38009), removed during the Phases I/II removal actions, was established in 1989 as a bioreactor during soil treatment activities for the former soil stockpile. Remedial action activities were conducted within the former Crosby & Overton tank areas in late 2002. Activities included the removal of 819 tons soil impacted by polychlorinated biphenyls (PCB) and carcinogenic polycyclic aromatic hydrocarbon (cPAH) for offsite thermal treatment and disposal. The excavation area and remaining PCB and PAH concentrations in soil are shown on Figures 5 and 6, respectively. Removal activities are documented in the Removal Actions Completion Report, Phases I/II RI Areas (Landau Associates 2003a).

2.1.5 EAST PROPERTY ROADWAYS

The East Property area, comprised of the easternmost 23 acres of the facility, is currently and historically an undeveloped area. During a 1996-1997 interim removal action on the East Property, approximately 100, 55-gallon drums and about 500 yd³ of PCP-impacted debris and soil were removed for offsite disposal from the former drum area and former small stockpile and soil removal area (Figure 2; Landau Associates 1997; 1998). During an additional investigation conducted in 2000-01, the presence of cPAHs in surficial soils was identified and appeared to be related to historical road oiling, as documented in historical aerial photographs from the late 1960s through 1970s. Impacts to groundwater were not observed. A soil remedial action for the East Property was implemented during the fall of 2002. The remedial action for the East Property resulted in the removal and disposal of 1,732 tons of cPAH-impacted soil for offsite thermal treatment and disposal. The east property soil remedial action is documented in the Soil Remedial Action Completion Report, East Property (Landau Associates 2003b). A conditional No Further Action (NFA) determination was granted to Time Oil by DEQ for the East Property on November 24, 2003.

2.2 PHYSICAL HYDROGEOLOGIC SETTING

Based on similar geologic soil types and hydrogeologic characteristics, four principal near-surface hydrogeologic units have been identified at the Terminal. In descending order from ground surface, these units include: 1) an upper zone, 2) a confining unit, 3) a lower zone, and 4) a deep sand unit. Depending on the continuity of the confining unit, the hydrogeologic units can act as distinct aquifer units with unconfined conditions in the upper zone and confined to semi-confined characteristics in the lower zone, or act as a single unconfined aquifer (beyond the western extent of the confining unit).

The upper zone at the Terminal consists of fine to medium sand and occurs in the surficial fill material and alluvial sands. The lower zone consists of a fine to medium sand to silty sand with multiple discontinuous interlayers of silt up to 6 ft thick, and occurs in interlayered river channel and overbank deposits. The upper and lower zones are separated by a silt confining unit across most of the Terminal. The silt unit consists of material that is characteristic of natural river overbank deposits and varies in thickness across the site from less than 1 ft to about 30 ft. The confining unit is thickest in the eastern portion of the Main Terminal Tank Farm area and the Bell Terminal Tank Farm area, and thins as it extends westward in the Main Terminal Tank Farm area toward the river where it eventually becomes discontinuous and no longer acts as a confining unit between the upper and lower zones.

Based on the hydrogeologic data for the Terminal, groundwater flow direction in the upper and lower zones is toward the Willamette River. Groundwater elevations measured during fourth quarter 2005 for the upper zone and lower zone are presented on Figures 7 and 8, respectively. Groundwater elevations at the Terminal in both the upper and lower zones vary seasonally, but the groundwater flow patterns presented for the fourth quarter 2005 event are representative of typical historical observations. During the fourth quarter 2005 and historically, groundwater elevations indicate that groundwater flow in the upper zone is generally to the west-southwest toward the Willamette River across the Main Terminal and Bell Terminal tank farm areas. A localized southward shift in groundwater flow in the upper zone, which has historically been apparent within and downgradient of the former PCP mixing area, appears to be due to the influence of the east-west trending storm drain located about 170 ft north of the southern property boundary. Groundwater elevations in the lower zone are influenced by diurnal river stage fluctuations and groundwater flow from the upper zone to the west across the confining unit boundary. In the area where the confining zone is absent toward the river, ground elevation contours indicate that pumping of recovery well RW-2 has modified groundwater flow in the lower zone in proximity to the pumping well, as described in Section 4.2.1. Groundwater flow in the lower zone outside the well RW-2 capture zone is generally west/southwest toward the Willamette River.

2.3 LAND AND BENEFICIAL WATER USE EVALUATIONS

In accordance with OAR 340-122-080 (e) and (f), evaluations were conducted regarding current and reasonably anticipated future land use and regarding current and reasonably likely future beneficial water use at the Terminal and surrounding areas, as part of the RI. The information collected during these evaluations was reported in the Phase II RI report (Landau Associates 2001) and was updated in the Phase III RI report (Landau Associates 2005a).

Based on the evaluations, the current and historical land use for the Terminal and the adjacent properties is and was primarily industrial with some commercial use. The current zoning of the Terminal property is heavy industrial (IH), which is also the comprehensive plan designation for the site property. This designation indicates that the likely reasonable future land use at the Terminal and surrounding properties is and will remain as heavy industrial.

The evaluations also identified the current and likely future beneficial use of groundwater and surface water at the Terminal, at adjacent properties, and within a 1-mile radius of the Terminal as primarily industrial with some use for irrigation. Shallow groundwater at the Terminal is not considered suitable for beneficial use. For the upper zone, aquifer yield is low (less than 1 gpm) and the unit is discontinuous: therefore, the upper zone would not likely support long-term use for any purpose. For the lower zone, aquifer yield appears to be adequate for low production use (approximately 10 gpm based on sustainable yield from the groundwater interim action system); however, because of its interconnection with the upper zone and its heterogeneous nature, it is possible that this yield would not be sustained for long-term use. Additionally, groundwater used for water supply throughout the Portland area has been typically derived from the deeper Troutdale aquifers, probably because of their significantly higher yield. Therefore, based on the significantly more favorable hydrogeologic characteristics of the Troutdale aquifers and historical groundwater use in this area, as well as the readily available City of Portland water supply, it was determined unlikely that the shallow water-bearing units defined at the Terminal would be used in the future for water supply. DEQ concurred with this determination in its NFA letter for the East Property (DEQ 2003a).

Lower zone groundwater discharges to the Willamette River and may provide some recharge benefit to the river, although the flow volume would be minimal compared to in-stream Willamette flows.

2.4 SOURCE AREAS

Sources that have affected soil and groundwater quality at the Terminal were related to historical operations described above: 1) the wood treatment formulation operation in the former PCP mixing area and former PCP warehouse area; 2) petroleum handling and storage in the Main Terminal and the Bell

Terminal Tank Farm areas and associated loading rack and petroleum handling areas; 3) storage of waste oils in tanks in the former Crosby & Overton area; 4) "oiling" of roads (likely for dust suppression) on the East Property; and 5) unknown sources along the western property boundary of the Bell Terminal Tank Farm area outside the tank farm wall and on the adjacent former Premier Edible Oils (PEO) property to the west. Contamination to soil on the East Property has been addressed through a soil remedial action and the soil to groundwater pathway has been effectively eliminated. Because DEQ has issued a conditional NFA determination for the East Property portion of the Terminal, further discussion is focused on the other areas of the Terminal.

Upland COIs discussed below were identified by consistent detections of constituents based on soil data collected during various investigations, quarterly groundwater monitoring results, and historical site operations and uses in upland areas of the terminal. The data summarized in the following sections were presented in the Phase III RI report (Landau Associates 2005a) and the most recent groundwater monitoring and groundwater interim action status reports (fourth quarter 2004 through fourth quarter 2005; Landau Associates 2005c,d,e,f; 2006a). Monitoring well locations are shown on Figure 3. A summary of the most recent quarterly results (fourth quarter 2005) is included in Table 2-1. For the purposes of the source control evaluation, upper and lower zone contaminant concentration maps for the fourth quarter 2005 event have been combined except for chromium and copper (Figures 9, and 11 through 14). Since groundwater from both zones combine beyond the extent of the confining zone into a single water-bearing zone, these maps represent the combined concentrations of contaminants that have the potential to migrate to the river.

2.4.1 FORMER PCP MIXING AREA AND WAREHOUSE

Two source areas for PCP-related contamination (e.g., PCP by-products and dioxins/ furans) have been defined at the Terminal. These areas are the former PCP mixing area (including the area below the former PCP warehouse) and the northwestern portion of former Crosby & Overton tank area (Figure 2). The primary contaminant of concern resulting from the historical blending of specialty wood treating products is PCP. As discussed in the RI report, releases of PCP, carriers, additives, and PCP formulations to soil in the PCP mixing area appear to have occurred during the mixing operations. These releases resulted in the primary source of PCP contamination (and related constituents) to soil in this area with historical PCP soil concentrations exceeding 100,000 mg/kg. Based on historical upper and lower zone groundwater data, the former PCP mixing area was also identified as a significant or primary source of PCP contamination to groundwater with historical concentrations in the upper zone exceeding 60,000 µg/L. PCP concentrations detected in the lower zone have been as high as 18,000 µg/L. Based on the magnitude of PCP detections in the soil and groundwater in and downgradient of the PCP source area

and information about the PCP formulations, there is the possibility that free-phase PCP (dense non-aqueous phase liquid (DNAPL)] with a carrier was used, providing a potential residual source of PCP. However, to date, there has been no direct observation or evidence of DNAPL at the Terminal.

Contaminated soil was removed from the former PCP mixing area and below the footprint of the former PCP warehouse during a soil removal action in the fall of 2002. Where possible, soil exceeding PCP concentrations of 5 mg/kg was removed from these source areas for offsite incineration and disposal. However, soil containing PCP concentrations above 5 mg/kg still remains in some areas, mainly at or below the water table (Figure 4). An interim remedial action using an *in situ* chemical oxidation (ISCO) remediation technique is currently being implemented to address PCP-impacted soil and groundwater both in and downgradient of these source areas, as discussed further in Section 4.2.3.

The most recent groundwater analytical data (fourth quarter 2005) indicate that six wells contained detected PCP concentrations ranging from 0.852 to 2,060 µg/L. The highest concentrations were detected in the samples from wells OX-7S and OX-8S [2,060 and 377 µg/L, respectively], located within and downgradient of the former PCP mixing area. OX-2S was not sampled during fourth quarter 2005 due to the presence of product in the well (0.07 ft thickness).

Dioxin and furan analyses were performed on groundwater samples from wells OX-1S, OX-6S, and RW-1, which are located within and downgradient of the former PCP mixing area during the fourth quarter 2005 event. Results from these analyses indicated concentrations, as total equivalency quotient (TEQ), ranged from 2.54×10^{-4} nanograms per liter (ng/L) (RW-1) to 1.95×10^{-2} ng/L (OX-6S).

2.4.2 TANK FARM AREAS

Three primary source areas for diesel-range and gasoline-range petroleum hydrocarbon contamination (and related constituents) have been identified on the Terminal property based on concentrations of these contaminants detected in soil and groundwater. These areas include the Main Terminal Tank Farm area, the central portion of the Bell Terminal Tank Farm area, and an area along the western boundary of the Bell Terminal Tank Farm area. Another source area appears to occur downgradient of the Bell Terminal Tank Farm area on the former PEO property where significant historical releases have been documented in the area of the former diesel ASTs.

Contaminants in soil and groundwater at the Terminal associated with petroleum storage and handling operations include mainly petroleum hydrocarbons, PAHs, and VOCs. The presence of these contaminants is consistent with the historical uses of the Terminal for bulk storage of petroleum products. The graphical results presented in this document focus on VOCs (benzene and ethylbenzene) because these constituents are related to former petroleum operations at the terminal, have been detected at

concentrations deserving evaluation, and have JSCS screening level values. However, all detected constituents were evaluated using the JSCS SLVs, if available (see Section 5.0). Total petroleum hydrocarbons (diesel and gasoline-range) are not included in the source control evaluation because no published JSCS screening level values are currently available for assessment of these constituents in water or soil. Presentation of the TPH results are provided in the Phase III RI report and quarterly groundwater monitoring reports.

The most recent groundwater monitoring events for the Main Tank Farm area and Bell Terminal Tank Farm area were conducted in November and August 2005, respectively. (At DEQ's request for simultaneous sampling of wells at the Bell Terminal and at the PEO site, sampling of the Bell Terminal wells has been discontinued until additional data is scheduled to be collected at the Schnitzer property.) Figures 11 and 12 show concentrations of benzene and ethylbenzene during the most recent sampling event conducted in the tank farm areas.

2.4.2.1 Main Terminal Tank Farm Area

Past releases of petroleum products have been documented in the Main Terminal Tank Farm area. Specifically, a release of diesel occurred in 1975 when Tank 29508 split along a vertical weld. An unleaded gasoline spill in 1994 was also reported in the Main Terminal Tank Farm area. Such releases have provided a source for petroleum-related constituents (e.g., VOCs, PAHs, and diesel-range and gasoline-range petroleum hydrocarbons). Reported spills within the Main Terminal Tank Farm area are summarized in the following table:

Date	Material(s) Released	Volume Spilled (Gallons)	Spill Surface (Gravel, Asphalt, Sewer)	Action Taken (Yes/No)
1975	Diesel	Unknown	Soil in bermed area	Yes – free product recovery and soil removal
1990	Ethanol	~500 gallons	Soil in bermed area	Yes - Product and groundwater recovery
1994	Unleaded Gasoline	1300 gallons	Soil in bermed area	Yes – Product recovery and long-term groundwater monitoring
1999	Ethanol	2,479 gallons (suspected)	Subsurface soil	Yes - Installed recovery well and conducted groundwater monitoring; no product ever observed

Unquantifiable leaks along pipelines conveying petroleum products may have also provided a source for the petroleum hydrocarbon contamination in soil and groundwater in this area. LNAPL has been observed at locations within the Main Terminal Tank Farm area in the area of the 1994 spill and more recently in the central portion of the Main Terminal Tank Farm area, which is likely related to periodic leaks along conveyance pipelines. To a lesser extent, inadvertent spills near the loading rack and entrance to the Terminal may have occurred during truck loading/unloading and may have provided a source of petroleum products to soil and groundwater in this area. LNAPL occurrence in the Main Terminal Tank Farm area is discussed in more detail in Section 3.3. The well locations where LNAPL has been observed historically and currently are shown on Figure 10.

As shown on Figures 11 and 12, the maximum concentrations of benzene and ethylbenzene were observed in wells P (2,470 $\mu\text{g/L}$) and N (131 $\mu\text{g/L}$), respectively during the November 2005 event. The most elevated benzene concentrations were observed in an area where the 1994 gasoline spill occurred and where LNAPL has historically been observed (Figure 10). Elevated ethylbenzene concentrations were also observed in this area and in two other areas. These two other areas, located within and near the southeast corner of the Main Terminal Tank Farm area, although adjacent, are likely associated with separate historic activities at the terminal (Figure 12). The plume to the west, including well LW-8S, is likely associated with spills related to former petroleum operations within the Main Terminal tank farm area. The plume to the east, including wells RW-1 and LW-11S is likely associated with carrier fluids used with PCP during wood treatment formulation activities within the former PCP mixing area. This interpretation is supported by the results for a product sample collected from well LW-11S in November 2000, which contained 3.2 percent PCP in addition to other petroleum constituents, versus the results for the product samples collected from wells LW-21S and LW-27S in April 2004, which contained only petroleum constituents (e.g., gasoline-, diesel-, and motor oil-range TPH). Also, the plume in the area around well LW-8S appears to be associated with the former petroleum operations in the Main Terminal tank farm area because upper zone groundwater flow in this area is to the south-southwest and constituents originating in the former PCP mixing area (e.g., PCP) have not been observed at well LW-8S.

2.4.2.2 Bell Terminal Tank Farm Area

No past releases in the Bell Terminal Tank Farm area or along the western property boundary of the Bell Terminal have been reported. Reported releases have occurred on the former PEO property located downgradient of the former Bell Terminal Tank Farm area. In the mid-1970s, the western portion of a conveyance pipeline that was used to convey petroleum products was demolished by Schnitzer during construction of the former PEO facility while still in use and containing product. This pipeline

trends east-west from the northernmost dock on the former PEO property through the center of the Bell Terminal. The demolition resulted in a release to soil in an area near the dock; any impacts of the release to other areas are unknown. Additionally, petroleum releases on the former PEO property reportedly occurred near the locations of the former diesel ASTs, where product has consistently been observed in nearby well MW-4.

Soil and groundwater concentrations collected within the Bell Terminal Tank Farm area and on the former PEO property suggest the presence of three commingled petroleum hydrocarbon plumes within this area: 1) one originating in the central portion of the Bell Terminal Tank Farm area, near the east-west trending pipeline, 2) one originating along the western property boundary in an area outside the tank farm walls, and 3) one originating on the eastern portion of the former PEO property where significant petroleum releases are known to have occurred (e.g., where the former diesel ASTs were located). The source for soil and groundwater impacts in the central portion of the Terminal is likely related to minor, incidental releases associated with operations of the Terminal. The source of petroleum contamination outside the operational area of the Bell Terminal near the western property boundary is unknown. Even though it is likely that the plume originating from the central portion of the Bell Terminal commingles with the plume originating near the western property boundary, and that both of the plumes commingle with other contamination originating on the former PEO property in the area where former diesel ASTs were located, it is unlikely that the elevated concentrations observed near the western property boundary of the Bell Terminal or on the former PEO property originate from the Bell Terminal tank farm operations. This conclusion is based on the decreases in soil and groundwater concentrations between the central portion of the Bell Terminal and the western property boundary, and the significant increase in both the soil and groundwater concentrations for petroleum constituents across the western property boundary and on the former PEO property. Also, product was observed with thicknesses of up to 6 ft in wells on the east portion of the former PEO property between 2001 and 2003 (the most recent data available), but no product has ever been observed within wells or in soil within the Bell Terminal Tank Farm area at over 50 soil sample locations, 14 well locations, and 20 direct push groundwater sample locations. Because the confining unit boundary on the former PEO property is estimated within the likely source area where the former diesel ASTs were located on the eastern portion of the PEO property, the elevated groundwater concentrations in this area could reflect groundwater contamination resulting from direct releases to soil where the confining unit is not present or downgradient flow of contaminated groundwater from the upper zone across the confining unit boundary. However, in the latter case, concentrations would typically decrease instead of increase in the downgradient direction.

Despite the differences in TPH concentrations, benzene and ethylbenzene have not been detected in the Bell Terminal Tank Farm area above laboratory reporting limits during the last five quarters of groundwater monitoring.

2.4.3 FORMER CROSBY & OVERTON TANK AREA

In the former Crosby & Overton area, PCBs and cPAHs are the primary contaminants of concern due to apparent releases to soil during storage and removal of the oil historically stored in tanks or cleaning of tanks in this area. Contaminated soil was removed from depths ranging from 0.5 to 2.5 ft below the ground surface (BGS) from this area as part of the removal actions for the East Property and former PCP mixing area in the fall of 2002. PCB and cPAH contamination appeared to be limited to surface soil in the former Crosby & Overton source area. No impacts to groundwater have been observed in this area. The residual concentrations of PCBs and cPAHs in soil are shown on Figures 5 and 6.

2.4.4 OTHER CONSTITUENTS

In addition to the COIs associated with operations at the Terminal, metals, including chromium, copper, nickel and zinc, have also been observed in groundwater. As shown on Figures 13 and 14, elevated concentrations of chromium and copper were observed in an area extending from the central portion of the Main Terminal tank farm area toward the north property boundary, at LW-11D and at LW-10D (for copper only), and at two locations in the Bell Terminal tank farm area. Based on knowledge of historical operations at the Terminal, the presence of metals is unlikely related to terminal operations. As described in more detail in Appendix A, reducing groundwater conditions likely exist over most of the upper and lower zones with more oxidizing conditions occurring during periods of river recharge at locations closer to the river and at locations outside the area where petroleum constituents are observed. Also, biodegradation is likely occurring or has historically occurred within the dissolved petroleum plumes within both groundwater zones. The presence of metals in lower zone groundwater does not appear to be directly related to the presence of petroleum constituents and reducing conditions resulting from their biodegradation, because a correlation can not be made between petroleum constituent and metals concentrations. For example, gasoline- and diesel- range hydrocarbons, benzene, toluene, ethylbenzene, and xylenes (BTEX) are not detected in the lower zone at the same locations where metals concentrations are greatest (e.g., LW-35D, LW-27D, LW-1D, etc.).

3.0 POTENTIAL MIGRATION PATHWAYS TO RIVER FROM IMPACTED MEDIA

Releases of contaminants at the source areas have apparently occurred during operation of the Terminal. Contamination of soil at each of the source areas appears to be the result of releases of hazardous substances directly onto the soil and subsequent migration. At the former PCP mixing area, these releases occurred during PCP formulation activities. At the former Crosby & Overton area, the releases occurred during lease operations. In the Main Terminal Tank Farm area and loading racks, these releases occurred due to spills and possibly leaking along conveyance pipelines and/or from activities associated with bulk fuel storage. In the Bell Terminal Tank Farm area, these releases may have occurred due to activities associated with bulk fuel storage as well as unknown activities along the western property boundary. It appears that separate releases occurred on the adjacent former PEO property. A conceptual site model for the Terminal, which includes a schematic of the source areas, release mechanisms, and transport mechanisms is provided on Figure 15.

The predominant potential migration pathway for transport of contaminants to the river is via groundwater (i.e., dissolved phase). Other potential migration pathways addressed in this source control evaluation include a preferential migration pathway for contaminated groundwater via the storm drain, LNAPL migration, stormwater/upland surface water runoff, and soil erosion/catch basin sediment. Each potential migration pathway is discussed in detail below.

3.1 GROUNDWATER MIGRATION – DISSOLVED PHASE

In some areas of the Terminal, dissolved phase contamination in groundwater has resulted from contact between infiltrating water and contaminated soil in the unsaturated zone and/or subsurface water and NAPL, or downward vertical migration of shallow groundwater contamination to the lower groundwater zones through discontinuities in the confining unit or across the confining unit boundary. Based on the hydrogeologic data for the Terminal, groundwater flow direction in the upper and lower zones is toward the Willamette River. Groundwater elevations measured during fourth quarter 2005 for the upper zone and lower zone are presented on Figures 7 and 8, respectively. Groundwater seeps have not been observed along the riverbank adjacent to the Terminal, so groundwater likely discharges to the river below the water line. Consequently, there is a potential for dissolved chemicals in groundwater or LNAPL from the Main Terminal Tank Farm area to be transported to the river by groundwater flow. However, there does not appear to be a current complete migration pathway for groundwater contamination to the river at concentrations exceeding screening levels (see Section 5.0).

3.1.1 PCP MIXING AREA

The majority of the contaminated soil from the former PCP mixing area and former soil stockpile area has been excavated and disposed offsite. However, at the conclusion of soil removal activities, residual amounts of PCP at concentrations greater than 5 mg/kg still remained at depths typically at or greater than 13 ft BGS (the approximate water table elevation) within and directly adjacent to the mixing area. ISCO injections conducted within the former PCP mixing area are likely to have further decreased the residual concentrations (see Section 4.2.3.)

PCP formulations were likely introduced into the environment through spills of PCP-containing NAPL directly onto the ground surface and subsequent migration through the subsurface to groundwater. Historical information indicates that most of the PCP formulations were less dense than water (i.e., specific gravity of less than 1) and, therefore, would migrate through the environment as LNAPL; however, at least one formulation had a density greater than 1 and could move as DNAPL through the subsurface. LNAPL has been observed in wells LW-11S, OX-1S, OX-2S, and OX-3S, which are located downgradient from the PCP mixing area. DNAPL has never been observed.

Elevated levels of PCP in the upper zone and lower zone groundwater at the Terminal indicate that PCP has partitioned from the soil and/or NAPL into the groundwater. PCP has been observed in groundwater in both zones in and to the south and southwest (downgradient) of the former PCP mixing area. Historically, low PCP concentrations have also been detected within the deep sand unit near where well LW-12D2 was previously located within the former PCP mixing area. The available data suggest that the primary source of the groundwater contamination in the upper zone results from partitioning of PCP from the residual amounts remaining in the soil within and adjacent to the former PCP mixing area and subsequent advective migration from this area, or from partitioning of LNAPL that has migrated downgradient from the PCP mixing area along the water table surface. LNAPL in the downgradient wells has not been observed consistently or over a wide area and is typically associated with very low seasonal groundwater levels. This inconsistent occurrence suggests that the LNAPL exists most of the year in a residual phase within the subsurface adjacent to these wells, and then is released/mobilized to the wells when water levels are low. PCP break-down products (e.g., trichlorophenols, tetrachlorophenols, etc.) have typically not been detected in groundwater indicating that the PCP has not typically degraded. Dioxins/furans tend to bind to soil particles; however, dioxins/furans have been detected in groundwater within the PCP plume area, likely indicating partitioning from LNAPL within or downgradient of the source area.

PCP in the lower zone likely results from downward migration of dissolved PCP via groundwater from the upper to the lower zone where the silt layer separating the upper and lower zones is heterogeneous and/or discontinuous across the confining unit boundary. No DNAPL has been

encountered during any of the investigations to date. Therefore, downward migration across the confining unit likely occurs under the natural downward groundwater gradient within the upper zone plume resulting in the elevated concentrations detected in the lower zone. Under this scenario, the PCP concentration distribution within the lower zone would appear to mimic that of the upper zone, while mean groundwater flow in the lower zone would still be toward the river. This distribution is reflected by the observation of the highest historic concentration of PCP in the lower zone at a downgradient location from the source areas in the upper zone. Further migration of dissolved PCP in the lower zone groundwater would be primarily controlled by advective groundwater flow in a downgradient direction from the impacted area.

Historically and currently, the PCP in the upper zone is limited to a narrow plume that extends from the former PCP mixing area downgradient about 350 to 450 ft to between LW-4S and LW-13S. The PCP concentrations in the upper zone are highest within and just downgradient of the former PCP mixing area. PCP appears to have migrated in a downgradient direction toward the south-southwest. Upper zone PCP concentrations within the mixing area have decreased significantly since the first sampling in 1991. This decrease may reflect the removal of contaminant source material during the 1989 soil excavation within the former PCP mixing area, as well as natural attenuation of the PCP (through adsorption, biodegradation, etc.) or downgradient movement past these monitoring points. PCP has not migrated in the upper zone farther downgradient to the south than well LW-13S, as indicated by the lack of detected concentrations in upper zone wells near the south property boundary (LW-10S, when saturated). The reduction in PCP concentrations and plume extent in the upper zone since 2002 is likely related to the removal of the majority of the remaining contaminated soil during the soil removal in the former PCP mixing area and, within the last year, to implementation of the ISCO remediation technique.

The PCP contamination observed in the lower zone historically consisted of several discrete areas of contamination rather than a contiguous plume. The discrete areas were mainly located within and near the former PCP mixing area, in proximity to well LW-11D, and in an area including wells LW-4D and RW-2. The highest PCP concentrations in groundwater in the lower zone, which occurred at well LW-4D (18,000 ppb in October 1997), have decreased significantly at this location and since spring 1999, the PCP concentrations at this location have been mostly below the laboratory reporting limits.

PCP concentrations in groundwater from downgradient wells closest to the river are typically non-detect. Since November 2002, low level PCP concentrations (generally less than 1 µg/L) have been detected on an intermittent basis in wells LW-6D and LW-9D (located between LW-4D and the river), and well LW-10D (located at the southern property boundary). These detections have not been observed on a consistent basis, which may be related to dilution of groundwater by river water at the groundwater-

surface water interface (particularly in the lower zone where the river stage influence is greatest); natural attenuation processes (e.g., adsorption, biodegradation, etc.); or seasonal variability.

Low concentrations of PCP (1 to 3 µg/L) were detected in the deep sand unit at LW-12D2 sporadically (three times) during quarterly monitoring between May 1999 and June 2002. This well was subsequently abandoned in advance of the soil removal action in the former PCP mixing area because it was located within the excavation area. The historical detections in this well were likely due to downward vertical migration of contaminants via groundwater flow between the upper and lower zone and between the lower zone and the deep sand unit. The source area for the impacts to the upper zone has been mitigated by the soil removal actions in 1989 and 2002, so the potential for ongoing groundwater impact in this area is considered to be low.

Beginning in October 2000, several source control methods have been used to contain PCP-impacted groundwater in the upper and lower groundwater zones. These source control methods are described in more detail in Section 4.2.

The concentrations of petroleum hydrocarbons and VOCs detected in wells downgradient of the former PCP mixing area are likely due to the presence of PCP carrier products (e.g., mineral spirits) that are present as LNAPL and the partitioning of these constituents into groundwater. The distribution of detected petroleum hydrocarbon concentrations in this area is consistent with the intermittent presence of LNAPL observed in well LW-11S, the recent occurrence of LNAPL at wells OX-1S, OX-2S, and LX-3S; and the presence of elevated PCP concentrations in groundwater. The intermittent nature of LNAPL occurrences at LW-11S appears to be related to seasonal groundwater fluctuations, such that residual LNAPL is observed in nearby monitoring wells under low water table conditions or to effects from the ISCO implementation events.

3.1.2 TANK FARMS

Soil contamination by petroleum-related constituents in the Main Terminal and Bell Terminal Tank Farm areas occurs primarily at depth within the capillary fringe. The elevated concentrations of contaminants within the capillary fringe in the Main Terminal and Bell Terminal Tank Farm areas indicate that releases of petroleum substances to the ground surface were historical and that NAPL has had sufficient time to migrate downward and spread laterally within the capillary fringe. The presence of the same contaminants both in groundwater and in soil indicate that these contaminants have partitioned from the soil and/or NAPL into the groundwater. Most of the shallow soil samples containing elevated petroleum hydrocarbon concentrations did not contain elevated benzene or ethylbenzene concentrations, indicating that the low molecular weight aromatics (e.g., BTEX) that may have once been present have undergone biodegradation or volatilization, or have been reduced by infiltrating precipitation.

In the Main Terminal Tank Farm area, contaminants are present in the upper and lower zone groundwater. However, contamination of the lower zone groundwater is typically found only in the western portion of the Main Terminal Tank Farm area where the silt confining unit separating the upper and lower zones does not exist or is discontinuous. In this portion of the Main Terminal Tank Farm area, only a single unconfined groundwater zone exists. In the eastern portion of the Main Terminal Tank Farm area, where the silt layer separating the upper and lower groundwater zones is present, contaminant concentrations in the lower zone groundwater are typically low and are primarily detected near where the silt layer pinches out or becomes discontinuous. This suggests that the silt layer over much of the western portion of the Main Terminal Tank Farm area provides a natural geologic/hydrogeologic boundary between the upper zone groundwater and the lower zone groundwater, limiting the vertical migration of contaminants over this portion of the Main Terminal Tank Farm area, or that the characteristic of the contaminant does not lend itself to vertical migration.

In the Bell Terminal Tank Farm area, contaminants are present in the upper zone groundwater, but not in the lower zone groundwater. The lack of contaminants in the lower zone groundwater indicates that the silt confining unit between the upper and lower zones is acting as an impermeable boundary and the two groundwater zones are not interconnected in this area. Concentration contours for selected contaminants in upper zone and lower zone groundwater (Figures 9, and 11 through 14) indicate that lateral migration in the downgradient groundwater direction has occurred. The lateral migration is likely a combination of the individual contaminant properties (e.g., solubility) and the processes of advection, hydrodynamic dispersion, and adsorption. The lack of contaminants in groundwater upgradient of the source areas indicates that contaminant migration in groundwater is primarily due to advection (transport of constituents by groundwater movement). For contamination in the groundwater along the western property boundary of the Bell Terminal Tank Farm area or on the former PEO property, there is not enough information about the nature of the release to determine the mechanisms affecting migration. However, the downgradient extent of petroleum constituents in the Bell Terminal Tank Farm area suggests that lateral movement of the contaminants is slow, which may be due to a low rate of advection in this area; possible natural attenuation (through adsorption, biodegradation, etc.); and/or volatilization.

The distribution of petroleum constituent concentrations within and downgradient of the Bell Terminal Tank Farm area suggest the presence of three commingled groundwater plumes, as discussed earlier. Except for low level metals in lower zone wells at the Bell Terminal Tank Farm area (Figure 13 and 14), concentrations of petroleum constituents, such as benzene and ethylbenzene, have typically not been detected in groundwater. Groundwater from the Bell Terminal is expected to flow west toward the Willamette River; it is unknown whether a complete contaminant migration pathway via groundwater exists from the former PEO property.

3.2 STORM DRAIN – PREFERENTIAL PATHWAY FOR GROUNDWATER

The storm drain (Figures 2 and 17) and backfill associated with its construction appear to affect groundwater flow and contaminant transport in the upper zone. The presence of the storm drain may partly explain the southerly components of upper zone groundwater flow in the Terminal area as groundwater flows toward the zone of higher hydraulic conductivity (i.e., the storm drain pipeline backfill). The storm drain pipeline does not appear to fully penetrate the confining unit (where present) and, therefore, is not considered to provide a vertical pathway for groundwater flow and contaminant transport to deeper aquifers. Groundwater samples collected from manholes in the storm drain and at the storm drain outfall in the river in 2001 and 2002 (Table 3) indicate that the storm drain was serving as a preferential pathway for upper zone groundwater to the river.

A stormwater intercept system was installed in 2002 to eliminate the potential for PCP-impacted upper zone groundwater to migrate through the storm drain to the river. A detailed description of the intercept system is provided in Section 4.2.2. Groundwater that may migrate within the pipeline fill outside the pipeline is likely not collected by the storm drain intercept system. However, PCP concentrations have not been detected in river outfall samples since implementation of the storm drain intercept system.

3.3 LIGHT NON-AQUEOUS PHASE LIQUID (LNAPL) MIGRATION

LNAPL has been observed both historically and currently in the area downgradient of the former PCP mixing area (in wells LW-8S, LW-11S, OX-1S, OX-2S, and OX-3S) and in the former Main Terminal Tank Farm area (in wells N, P, Q, LW-21S, and LW-27S), as shown on Figure 10 and in Table 2.

In the Main Terminal Tank Farm area, the maximum LNAPL thickness was observed in well N in July 1997 (1.20 ft); however, no LNAPL has been observed in well N since November 2002. The maximum LNAPL thickness observed in wells P and Q were 0.17 ft (July 1997) and 0.42 ft (November 2001), respectively. No LNAPL has been observed in wells P and Q since October 2003 and November 2004, respectively. The maximum thickness of LNAPL observed in wells LW-21S and LW-27S was observed in February 2004, at thicknesses of 1.03 ft and 0.69 ft, respectively. LNAPL has been observed at thicknesses of less than 0.16 ft in wells in the Main Tank Farm area during the last year. Also, LNAPL thicknesses have decreased over time at each of the wells where LNAPL was observed (Figure 20). This decrease is likely due to a combination of passive recovery techniques and natural attenuation processes. LNAPL has never been observed in wells located at the top of the riverbank or in the shoreline wells

(Figure 18). The results of the MNA evaluation which included assessment of the migration potential of the LNAPL are discussed in Section 6.0.

In the area downgradient of the former PCP mixing area, LNAPL containing PCP was observed in wells LW-8S, OX-1S, and OX-3S in November 2004 only, at thicknesses of 0.04 ft, 0.03 ft, and 0.33 ft, respectively. LNAPL was observed in well LW-11S at a maximum thickness of 0.37 ft in November 2000, although no LNAPL has been observed in that well since November 2004. LNAPL is consistently detected in well OX-2S, with a maximum thickness of 0.31 ft observed in October 2003. During the four sampling events conducted in 2005, the maximum thickness observed in well OX-2S was 0.23 ft. As shown on Figure 19, LNAPL thicknesses in this area have decreased over time. This decrease is likely due to use of ISCO in proximity of the wells containing LNAPL downgradient of the former PCP mixing area.

As shown on Figure 19, LNAPL thicknesses appear to correlate with groundwater level fluctuations such that LNAPL thicknesses increase at historically high groundwater conditions (LW-21S and LW-27S) and at historically low groundwater conditions (LW-11S). These increases are likely related to the release of residual LNAPL in the vadose zone as groundwater levels get shallower and closer to the ground surface where the source of the LNAPL originated (LW-21S, LW-27S), or due to the release of residual LNAPL bound up in previously saturated pore spaces as the water levels decrease (LW-11S).

3.4 STORMWATER/SURFACE WATER RUNOFF

Stormwater primarily infiltrates at the Terminal. In areas where stormwater runoff occurs, the stormwater is routed to an onsite stormwater treatment system (SWTS) or collected into the storm drain lines for discharge to the Willamette River. Stormwater from the former industrial areas of the terminal, including the loading rack along the rail spur, the truck loading rack, the valve pit on the vessel dock, and the other areas where valves exist is routed to the SWTS. The discharge from the SWTS to the stormwater drainage system, which ultimately discharges to the Willamette River following treatment, is regulated by the provisions of NPDES Permit 1200-Z.

Stormwater from the terminal entrance area and the low topographic area east of the rail spur and from the other areas of the Terminal during storm events is collected into the storm drain line for untreated discharge into the Willamette River. The stormwater flow route is shown on Figure 17.

The storm drain line runs east-west along the length of the Terminal about 160 ft north of the southern property boundary (Figures 2 and 17) to the river outfall. The storm drain was constructed before construction of the Terminal in 1943 and, therefore, backfill/construction details are not available. Internal inspection of a 600-ft section of the storm drain by remote video camera in April 2000 revealed

that the line is a 15-inch diameter concrete pipe. The pipeline appeared to be in good condition with few internal leaks. Several lateral lines to the main line were also observed in the Main Terminal Tank Farm area. One of the lateral lines was damaged during drilling of the horizontal well installed as part of the groundwater interim action (see Section 4.2.1). The lateral lines were subsequently abandoned and isolated from the main line using internal patches.

Stormwater data collected between September 2001 and August 2002 at the catch basin closest to the river contained PCP concentrations ranging from 0.7 to 190 $\mu\text{g/L}$ (Table 3). Except for diesel-range petroleum hydrocarbons, petroleum compounds (gasoline, mineral spirits, kerosene, and lube oil) were not detected. Diesel-range petroleum hydrocarbons were detected twice at concentrations of 0.261 mg/L and 0.3 mg/L. These data and the groundwater flow pattern in the upper zone indicated that upper zone groundwater was likely infiltrating into the storm drain pipeline. In October 2002, a groundwater intercept system was installed within the storm drain to capture groundwater between the two stormwater manholes closest to the river (see Section 4.2.2). Stormwater samples collected from the groundwater intercept system located in the catch basin closest to the river (SDM-1) continue to be analyzed as influent into the onsite WWTS on a quarterly basis (Table 3); however, these concentrations represent groundwater captured by the intercept system that do not reach the river outfall. Samples are also collected from the river outfall, when exposed during the quarterly sampling events.

In summary, stormwater runoff from the east property and from former operational areas of the terminal outside of the former PCP mixing area that does not infiltrate discharges to the Willamette River at the river outfall. Stormwater from former operational areas at the Terminal is collected and treated at the onsite SWTS, discharged to the storm sewer system under NPDES permit 1200Z, combined with the untreated stormwater from the east property (when present), and ultimately discharged to the Willamette River (Figure 17). Impacted media are not located within the area of stormwater runoff that discharges to the river; therefore, stormwater is not considered a current, potential contaminant migration pathway to the river. Potential historical releases to the river via the river outfall are being addressed by the Portland Harbor RI/FS.

No surface water body is present on or across the Terminal.

3.5 RIVERBANK SOIL EROSION AND CATCH BASIN SEDIMENT

Soil susceptible to potential erosion near the river embankment is outside of the bermed area that surrounds the Main Terminal Tank Farm area, to the west of where terminal operations were mainly located. Also, much of the river bank is either covered with vegetation or gravel fill and the beach is relatively wide, so the potential for riverbank erosion is limited. There are no records or evidence of spills from the pipelines along the dock where petroleum products were transferred from ships to the

Main Terminal Tank Farm area. Soil samples collected from the wells drilled on the shoreline do not indicate contamination, and no seeps, staining or other visual evidence of contamination has been observed. Soil erosion is therefore considered an unlikely pathway for contaminant migration.

Impacted surface soils in non-operational areas of the property that drain to the river outfall have largely been removed and replaced with gravelly fill at the ground surface. As discussed above, contamination of soil within the former Crosby & Overton tank area is anticipated to be the result of waste oil spills from the tanks historically located within this area. Because cPAHs and PCBs tend to absorb or bind to soil, contamination in this area was limited to the upper few feet of surface soil. As part of the soil removal action conducted for the former PCP mixing area and soil stockpile, impacted soil was excavated from the Crosby & Overton tank area and disposed offsite. Remaining PCP and cPAH concentrations in soil at completion of the removal action are shown on Figures 5 and 6 and confirm that the areal and vertical extent of the contamination was limited. Because historical releases in this area resulted in contamination that was limited to surface soil and groundwater contamination has never been observed in this area, the concentrations remaining in soil are considered to be protective of groundwater and additional cleanup in this area is not necessary. The residual soil concentrations are not expected to provide a complete exposure pathway to ecological or human receptors or provide a source of erodible soil, because the soil is buried under approximately 1.5 ft of backfill and groundwater quality results in this area before the removal action showed nondetect PCB and cPAH concentrations over a year period from 1997 to 1998. Also, residual PCP-impacted soil resulting from the historical PCP mixing area operations only remains at depths more than 13 ft BGS and below the excavation backfill (Figure 4), and therefore would not provide a source of erodible soil to the storm drain system via stormwater.

Therefore, significant erosion and transport of impacted soil at the Terminal through the stormwater system is unlikely. Potential historical releases to the river via the river outfall are being addressed by the Portland Harbor RI/FS.

4.0 SUMMARY OF COMPLETED OR ONGOING SOURCE CONTROL/REMOVAL ACTIVITIES

This section summarizes the source control and/or removal activities that have been conducted or are currently ongoing at the Terminal to address source area impacts.

4.1 PCP-IMPACTED SOIL

Approximately 9,700 tons of contaminated soil were removed from the former PCP mixing area, below the footprint of the former PCP warehouse, and from the former soil stockpile area during a soil removal action in the fall of 2002. Where possible, soil exceeding PCP concentrations of 5 mg/kg was removed from these source areas for offsite incineration and disposal. However, soil containing PCP concentrations above 5 mg/kg still remain in some areas, mainly at or below the water table (approximately 13 ft BGS) at conclusion of the soil removal activities (Figure 4). The ISCO remediation technique being used for upper zone groundwater (see Section 4.2.3) is expected to address some of the PCP contamination in soil within the zone of groundwater fluctuation. Because the remaining PCP-contaminated soil is buried under approximately 13 ft of backfill, the soil is not likely to be transported by stormwater to the storm drain system.

4.2 PCP-IMPACTED GROUNDWATER

Source control methods currently being used to capture and treat PCP-impacted groundwater consist of the following:

- Storm Drain Intercept System – captures PCP-impacted groundwater in the upper zone that infiltrates into the storm drain pipeline in the area of the PCP plume.
- Horizontal Recovery Well – captures upper zone groundwater near the downgradient extent of the PCP plume in the upper zone during periods of seasonal high water levels.
- ISCO – treats upper zone groundwater and soil within the zone of groundwater fluctuation. ISCO has been used during three full-scale injection events within the PCP plume area in February 2005, June 2005 and January 2006.
- Vertical Recovery Well – captures lower zone groundwater at downgradient locations where elevated concentrations of PCP were historically recorded.

These methods are described in detail in the following sections. Because of the source control systems in place, there is not a current, complete contaminant transport pathway to the river for PCP-impacted groundwater.

4.2.1 GROUNDWATER RECOVERY AND ONSITE TREATMENT

To prevent further migration of PCP in upper zone and lower zone groundwater at the Terminal, a groundwater interim action was implemented. The system consists of two groundwater extraction wells, a horizontal well (HRW-1) in the upper zone and a vertical well (RW-2) in the lower zone, and a groundwater intercept system in the east-west trending storm drain at the manhole closest to the Willamette River (SDM-1; Section 4.2.2). These well locations and the location of SDM-1 are shown on Figure 3.

Pumping from recovery well RW-2 began in October 2000. Since startup of recovery well RW-2, with the exception of periodic shutdowns for system maintenance, groundwater has been extracted continuously from the lower zone. Through December 2005, approximately 19.5 million gallons of water have been removed from the lower zone at RW-2 and transferred to the onsite wastewater treatment system (WWTS) for subsequent treatment and discharge to the sanitary sewer under a publicly owned treatment works (POTW) permit with the City of Portland.

The horizontal well (HRW-1) was installed in the upper zone during April 2000 across the approximate downgradient edge of the PCP plume in the upper zone. Four piezometers (PZ-1 through PZ-4) were installed, and water level monitoring was performed in February through May 2002 in the area of the east-west trending storm drain and HRW-1 to assess why the desired pumping rate could not be achieved in HRW-1 (Figure 3). The water level monitoring indicated that the water level in HRW-1 was lower than in the surrounding upper zone monitoring wells. From the water level data collected to date, information collected regarding the storm drain line, and the nature of the confining unit, it is believed that there is a hydraulic interconnection between the upper and lower zones in the area of the horizontal well. Based on this information and observed conditions, pumping of HRW-1 is limited to the wetter months of the year (i.e., December through May). Approximately 332,000 gallons of groundwater have been removed from HRW-1 since startup and transferred to the onsite WWTS for subsequent treatment and discharge to the sanitary sewer under a POTW permit with the City of Portland.

4.2.2 STORM DRAIN INTERCEPT SYSTEM

During installation activities for HRW-1, a lateral from the main storm drain was penetrated. A subsequent investigation was conducted to assess the impact of the east-west trending storm drain, located approximately 15 to 20 ft south (downgradient) of HRW-1, on upper zone groundwater. Samples were collected from two manhole locations (SDM-1 and SDM-2) and from the storm drain outfall at the discharge point into the Willamette River and analyzed for PCP. Results indicated that groundwater from the upper zone was infiltrating into the concrete stormwater drain (Table 3).

Due to the inability to operate HRW-1 during the drier months from June through November and the potential for upper zone groundwater to infiltrate into the storm drain line, a groundwater intercept system was installed in the storm drain line on October 8, 2002, at the manhole (SDM-1) located closest to the point of discharge to the Willamette River. The system consists of an 8-inch diameter polyethylene pipe routed through the 15-inch storm drain line from manhole SDM-1A through manhole SDM-1 (Figure 17). Stormwater from the East Property and Terminal office area, as well as treated stormwater from the SWTS, is routed through the 8-inch liner pipe and discharged to the Willamette River. Potentially impacted groundwater entering the storm drain pipe between manholes SDM-1A and SDM-1 is routed through the annulus between the pipes and is collected in manhole SDM-1. The intercepted water is pumped from the manhole to Tank 16804 for processing by the onsite WWTS. Approximately 3 million gallons of water have been removed from SDM-1 since startup.

4.2.3 ISCO INJECTIONS

To further facilitate the remediation of PCP contamination in the groundwater and soil at the Terminal within the upper zone, ISCO injections have been implemented. The primary objectives of the ISCO injections are to reduce the concentration of PCP present in upper zone groundwater within the PCP source area, to reduce the extent of the PCP plume in the upper zone groundwater, and to reduce the concentration of PCP in the soil located within the zone of groundwater fluctuation (i.e., smear zone). The specific type of chemical oxidation that has been implemented for the interim action is based on Fenton's Reagent oxidation technology. The Fenton's Reagent chemical oxidation reaction is created by the combination of soluble iron with low concentrations of hydrogen peroxide to produce hydroxyl radicals ($\bullet\text{OH}$). The hydroxyl radical is a short-lived oxidizer that cleaves the carbon double bonds of chlorinated hydrocarbons (e.g., PCP).

To date, three full-scale injection events have been conducted in February 2005, June 2005, and January-February 2006. The results of the first two events were provided in the RI report and the first quarter 2005 groundwater monitoring and groundwater interim action status report (Landau Associates 2005d), respectively. The results for the February 2006 event are currently being evaluated. The injection points for all three events were primarily focused within the PCP plume area within the upper zone within and downgradient of the former PCP mixing area, as shown on Figure 22. The results from the first two events indicate that PCP concentrations were effectively reduced within the plume area. Figure 22 shows baseline PCP concentrations in the upper zone prior to the first ISCO injection in June 2004. Figures 22 and 23 show PCP concentrations following the first and second ISCO injections in August 2004 and February 2005, respectively. Figure 9 shows the most recent PCP concentrations. After the first ISCO event, PCP concentrations in upper zone monitoring wells within the PCP plume area were

reduced by 63 percent (OX-8S) to 92 percent (OX-3S) and following the second event, PCP concentrations were reduced by 3 percent (LW-11S) to 80 percent (OX-6S). Based on mass calculations of PCP before and after the two injection events, the ISCO injections appear to have caused a mass reduction of PCP of approximately 0.85 lbs, or 76 percent over a one year period. The results of the 2006 event will be provided in the First Quarter 2006 Groundwater Monitoring and Groundwater Interim Action Status Report (Landau Associates 2006b - in preparation).

4.3 PAH AND PCB-IMPACTED SURFACE SOIL REMOVAL

In the former Crosby & Overton area, PCB- and cPAH-impacted soil was removed as part of the removal actions for the East Property and former PCP mixing area in the fall of 2002. The removal action consisted of the removal and offsite treatment and disposal of 819 tons of soil from depths ranging from 0.5 to 2.5 ft BGS. Residual soil concentrations remaining within the soil removal area are shown on Figures 5 and 6. PCB and cPAH contamination appeared to be limited to surface soil in the former Crosby & Overton source area and has not been detected in groundwater. These residual concentrations are not expected to provide a complete exposure pathway to ecological or human receptors or provide a source of erodible soil, because the soil is buried under approximately 1.5 ft of backfill and groundwater quality results in this area before the removal action showed nondetect PCB and cPAH concentrations.

4.4 PASSIVE LNAPL RECOVERY

In the Main Terminal Tank Farm area, LNAPL has been observed since the first quarter 2004 in wells LW-21S and LW-27S (Table 2). Keck® passive product recovery bailers were installed at LW-21S and LW-27S in March 2004. The recovered LNAPL is removed during quarterly groundwater sampling events and temporarily contained in a 55-gallon drum onsite pending appropriate offsite disposal. Through December 2005, less than 5 gallons of LNAPL have been removed from these wells.

Also, LNAPL has been observed intermittently in wells L, P, and Q in the Main Terminal Tank Farm area (Table 2). Product socks have been placed in these wells when product has been observed and removed and replaced on a quarterly basis, as needed. Currently, there is no measurable product in these wells. The potential for LNAPL migration from the Main Terminal Tank Farm area is discussed in Section 6.0.

5.0 COMPARISON OF DETECTED GROUNDWATER CONCENTRATIONS AT TO JSCS SCREENING LEVEL VALUES

This section presents the results of a comparison of detected groundwater concentrations in nearshore wells to the JSCS screening level values (SLVs). Only groundwater results were compared to the JSCS SLV, because, as discussed in Section 3 and below, groundwater is the only potentially complete contaminant migration pathway to the Willamette River at the Terminal.

To assess the potential for a complete contaminant migration pathway from the source areas, concentrations of groundwater from wells in the following areas were compared to the JSCS SLVs:

- Shoreline (beach) wells on the Willamette River – represent groundwater concentrations downgradient of the Main Terminal Tank Farm area and near the point of groundwater discharge to the Willamette River.
- Bell Terminal Tank Farm well – represent groundwater concentrations at the downgradient edge of the Bell Terminal property, but upgradient from other potential sources on the former PEO property.
- Downgradient wells from the PCP groundwater plume – represent groundwater concentrations downgradient of the PCP plume area in the upper zone at wells located on the river bank less than 200ft from the river

The analytical results were compared to the SLVs presented in Table 3-1 of the JSCS. Any constituent detected during the five quarterly events between November 2004 and November 2005 was compared to the screening levels identified in Table 3-1 of the JSCS, as shown on Tables 4, 5, and 6.

5.1 SHORELINE WELLS

The Willamette River shoreline wells (LW-36D, LW-37D, LW-38D, and LW-39D; shown on Figure 3) were used for the comparison because the analytical results from these wells are representative of groundwater concentrations downgradient of the Main Terminal Tank Farm area and near the area of groundwater discharge to the river. The results of the comparison to the JSCS levels indicate that except for certain metals, no other constituents exceed the SLVs in groundwater at the shoreline wells. The TPH, BTEX, and selected metals (e.g., chromium, copper, and arsenic) results for these wells for the November 2005 event as well as the results for wells located along the riverbank are shown on Figure 16. As shown on Table 4, arsenic exceeded the SLVs regularly at wells LW-38D and LW-39D and during one event each at wells LW-37D and LW-38D. A site-specific background concentration established for arsenic (1.5 mg/L) in groundwater based on concentrations collected at wells on the East Property was not exceeded in any sampling event. Because these East Property wells were located outside of the terminal operation areas, the site-specific background concentration is representative of a

naturally occurring background level. Consideration of site-specific background concentrations is allowed for the weight-of-evidence approach under the JSCS. Other metals, including copper, lead, nickel, and zinc were detected intermittently at concentrations exceeding the JSCS SLVs. One sample collected at well LW-37D in November 2005 contained concentrations of arsenic, copper, lead and zinc that exceeded the SLVs. The overall higher turbidity measurement at this well during this event could be indicative of suspended material in this sample and could have biased the results high. Groundwater results for later events at this location, including both total and dissolved metals concentrations, showed concentrations less than the SLVs. The only other exceedances of the SLVs included total lead at well LW-37D in February 2005 (the three most recent events have been nondetect or less than the SLV) and a single occurrence (August 2005) for total and dissolved nickel at well LW-39D (all other nickel results were nondetect or less than the SLV).

The presence of metals concentrations in groundwater are not likely related to historical operations at the Terminal because the materials handled at the Terminal did not contain these constituents. This is further demonstrated by the fact that concentrations of all other constituents originating from Terminal operations are typically higher in the upper zone than in the lower zone, which is not the case for the metals concentrations. An evaluation of whether metals concentrations could be influenced by redox conditions in the lower zone was conducted as part of the MNA evaluation through the measurement of MNA parameters (including oxidation-reduction potential). The results of the MNA evaluation are included in Section 6.1. Further discussion of the metals concentrations are provided in Section 2.3.4. Under the groundwater screening procedures specified in the JSCS, a weight-of-evidence approach is allowed where concentrations exceed the SLVs. For these metals concentrations, considering the site-specific background concentration for arsenic (a regional background groundwater value is not available, but arsenic and other metals are ubiquitous throughout the area), the sporadic and low level nature of the other metals detections, and the lack of use of these constituents during terminal operations, source control should not be required for the metals constituents.

5.2 BELL TERMINAL TANK FARM WELLS

Groundwater concentrations from ten wells (seven upper zone, three lower zone) located within the Bell Terminal Tank Farm area were screened against the JSCS SLVs. These groundwater results represent groundwater concentrations within and at the downgradient edge of the Bell Terminal property, but upgradient from other potential sources on the former PEO property. Groundwater concentrations on the former PEO property at locations between the Bell Terminal and the river have not been monitored since 1998.

The results of the comparison to the JSCS levels indicate that except for certain metals, no other constituents exceed the SLVs in groundwater at the Bell Terminal. As shown on Table 6, arsenic exceeded the SLVs regularly at most of the wells, but did not exceed the site-specific background concentration. Other metals concentrations that sporadically exceeded the JSCS SLVs included copper, lead, nickel and zinc in the lower zone wells (LW-29D, LW-30D, and LW-32D). The presence of metals concentrations in the lower zone may be related to the presence of reducing conditions, but does not appear to be exacerbated by the presence of petroleum constituents. Petroleum constituents are typically nondetect in the Bell Terminal in the lower zone. For the reasons stated in Section 5.1 above, source control should not be required for metals in groundwater within the Bell Terminal.

5.3 PCP PLUME – DOWNGRADIENT WELLS

Two wells (LW-6D and LW-9D) are located on the riverbank within approximately 200 ft of the river shoreline. Groundwater concentrations from these wells were screened against the JSCS SLVs because the groundwater is representative of concentrations downgradient of the PCP plume, as shown on Table 5. PCP concentrations at these wells have typically been nondetect during the period of monitoring between 1997 to present. Between November 2004 and November 2005, PCP was detected at LW-6D on one occasion at a concentration less than 3.0 $\mu\text{g/L}$, the National Recommended Water Quality Criteria (organism only, consumption rate = 17.5 g/day; EPA 2002) and DEQ's Ambient Water Quality Criteria (AWQC) (organism only, consumption rate = 17.5 g/day; DEQ 2004; Figure 9), but slightly greater than the minimum JSCS SLV (0.3 $\mu\text{g/L}$; based on the 175 g/day consumption rate for the same criteria). The source control methods currently in place, as described in Section 4, have been effective in containing the migration of PCP to the river; and therefore, there is not a current complete contaminant migration pathway for PCP-impacted groundwater to the river.

Arsenic is the only other constituent detected in groundwater from these wells that routinely exceeds the minimum JSCS SLV (0.014 $\mu\text{g/L}$). However, none of the arsenic concentrations exceed the site-specific background concentration (1,500 $\mu\text{g/L}$). Other metals, copper and lead, also sporadically are observed at concentrations slightly exceeding the minimum JSCS SLVs (copper: 2.7 $\mu\text{g/L}$; lead: 0.54 $\mu\text{g/L}$). For the reasons stated in Section 5.1 above, source control should not be required for these low detections of metals in groundwater within or downgradient of the PCP plume area.

6.0 CONCLUSIONS AND PLANNED ACTIVITIES

Five potential migration pathways between impacted media within source areas at the Terminal and the Willamette River were identified during the source control evaluation. Based on information presented herein and the comparison of groundwater concentrations with the JSCS SLVs, we conclude that no pathway that transports contaminated media to the river at concentrations consistently greater than the JSCS SLVs or site-specific background levels currently exists at the Terminal. We justify this conclusion for each potential pathway defined in Section 3 below.

6.1 GROUNDWATER MIGRATION - DISSOLVED PHASE

Three source areas for potential groundwater migration of dissolved phase contaminants were identified at the Terminal. These source areas consist of the former Main Terminal Tank Farm area and Bell Terminal Tank Farm areas for dissolved phase petroleum hydrocarbon constituents, and the former PCP mixing area and warehouse for dissolved phase PCP.

- **Former Main Terminal Tank Farm Area:** Groundwater analytical data collected over the past year from the shoreline (beach) wells located downgradient of the Main Terminal Tank Farm area indicate that none of the constituents exceed the JSCS SLVs, with the exception of some metals. Concentrations of arsenic routinely exceed the SLVs but do not exceed the site-specific groundwater background concentration established for arsenic. The JSCS SLVs are exceeded for other metals (including copper, lead, nickel and zinc), but none on a consistent basis (Table 4). The presence of metals at these concentrations does not appear to be related to terminal operations because metals of this type were not used historically for site activities. The presence of metals at these concentrations is explained in Section 2.4.4. The monitored natural attenuation evaluation results (Appendix A) support these data and indicate that dissolved petroleum constituent concentrations are likely naturally attenuated between the source area and the river. Therefore, these data support the conclusion that even though there is a complete physical groundwater transport pathway to the river, there is not a current complete contaminant migration pathway via groundwater to the river from the Main Terminal Tank Farm area.
- **Former Bell Terminal Tank Farm Area:** The Bell Terminal Tank Farm area boundary is located more than 600 ft from the river shoreline. Groundwater concentrations for all petroleum-related constituents from the operational area of the Bell Terminal Tank Farm area do not exceed the JSCS SLVs (Table 5). Similar to the Main Terminal, arsenic concentrations routinely exceed the SLVs, but do not exceed the site-specific background concentrations. Other metals (including copper, lead, nickel, zinc) occasionally exceed the SLVs, but only in lower zone groundwater. Elevated groundwater concentrations along the downgradient western property boundary and on the former PEO property do not appear to be related to Time Oil operations; however, petroleum-related constituents do not exceed the JSCS SLVs along the western property boundary (where SLVs are available). Groundwater sampling has not been conducted on the PEO property since 1998. These data indicate that dissolved groundwater concentrations leaving the Bell Terminal property do not consistently exceed the JSCS SLVs; therefore, a contaminant migration pathway for groundwater concentrations exceeding the JSCS SLVs does not occur from the Bell Terminal.

- **Former PCP Mixing Area and Warehouse.** Groundwater concentrations between the defined PCP plume and river are typically nondetect for PCP-related constituents (Table 6). Similar to the tank farms, arsenic and other metals exceed the JSCS SLVs, but arsenic concentrations do not exceed the site-specific background concentration and the other metals are only observed sporadically at concentrations slightly above the JSCS SLVs. Groundwater downgradient of the former PCP mixing area and warehouse is currently being captured using the storm drain intercept system, the horizontal recovery well, the vertical recovery well, and ISCO techniques and recovered groundwater is treated by the onsite WWTS. These source control activities interrupt any potential migration pathways of the PCP-impacted groundwater to the river.

6.2 STORM DRAIN – PREFERENTIAL PATHWAY FOR GROUNDWATER

PCP-impacted groundwater that infiltrates into the storm drain is currently being intercepted and transferred to the onsite WWTS. Therefore, direct discharge of impacted groundwater through the storm drain to the river does not represent a current complete contaminant migration pathway. Potential historical impacts to the river via the storm drain are being addressed as part of the Portland Harbor RI/FS.

6.3 LNAPL MIGRATION

The migration potential of PCP from the former PCP-operation area is being addressed using ISCO techniques. The migration potential of LNAPL from the Main Terminal Tank Farm area was unknown, and therefore modeled as part of the source control evaluation (Appendix A). The MNA measurements and fate and transport modeling efforts indicated that LNAPL and associated contaminants were likely being attenuated before reaching downgradient locations near the point of groundwater discharge, and no reduction in concentration of contaminants in Main Terminal Tank Farm area wells was required to meet the JSCS SLVs in river bank wells in the future. Therefore, migration of LNAPL does not represent a complete current or future contaminant migration pathway to the river.

6.4 STORMWATER/SURFACE WATER RUNOFF

Stormwater runoff from former operational areas associated with the former industrial areas of the site is collected and treated at the onsite SWTS. Stormwater typically infiltrates on the East Property or in other non-operational areas of the Terminal. Any stormwater runoff from the East Property and other non-operational areas originates from non-impacted areas, and therefore is not a potential migration pathway for contaminants to the river.

6.5 RIVERBANK SOIL EROSION AND CATCH BASIN SEDIMENT

Soils susceptible to potential erosion near the river embankment are located outside the bermed areas that surround the tank farms (i.e., operational areas) and no records or evidence of spills have occurred near the river embankment. In addition, impacted surface soils in non-operational areas of the property have been removed and/or covered with fill; therefore, no erosion and transport of impacted soil to catch basins from these areas will occur.

6.6 PLANNED SOURCE CONTROL ACTIVITIES

Time Oil will continue to operate the groundwater interim action system for recovery of PCP-impacted groundwater in the upper and lower zones. Because of the minimum area impacted currently in the lower zone, Time Oil will continue to assess the need to maintain groundwater recovery efforts at RW-2. Also, an assessment of the overall success of the ISCO injections for treatment of PCP-impacted groundwater in the upper zone is currently being evaluated, based on the most recent event conducted in February 2006. The results of the ISCO event and any future recommendations will be provided in the upcoming First Quarter 2006 Groundwater Monitoring and Groundwater Interim Action Status Report (Landau Associates 2006b, in progress).


The results of the MNA parameter measurements and the fate and transport modeling indicate that anaerobic biodegradation is likely occurring within impacted groundwater in the Main Terminal Tank Farm area under natural aquifer conditions to attenuate LNAPL and dissolved contaminants from reaching the river, and a more aggressive method for remediation of the LNAPL is not necessary under current conditions. However, based on the current concentrations of sulfate and nitrate, continued biodegradation of these constituents may be limited. Other anaerobic biodegradation indicators (e.g., ferrous iron and methane) haven't been fully characterized; these indicators, as well as confirmation of the nitrate and sulfate results, may provide additional information on biodegradation capacities. Time Oil will continue to use passive recovery methods to remove measurable product from wells within the Main Tank Farm area, as necessary.


7.0 USE OF THIS REPORT

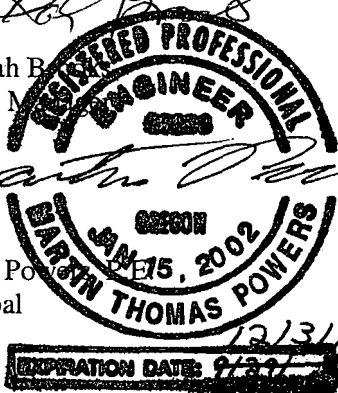
This source control evaluation report has been prepared by Landau Associates for the exclusive use of Time Oil Co. for specific application to the Northwest Terminal. Services for this project were conducted in accordance with the Environmental Services Contract between Time Oil Co. and Landau Associates, Inc. Landau Associates has performed our services in accordance with generally accepted engineering and consulting standards for environmental work in effect at the time and locality services were performed. The reuse of information, conclusions, and recommendations provided herein by Time Oil Co. or others in connection with any site other than the Northwest Terminal without Landau Associates' written permission shall be at the sole risk of Time Oil Co. and without liability to Landau Associates.

This document was prepared under the supervision and direction of the following key staff.

LANDAU ASSOCIATES, INC.


Rebekah B.
Project Manager


Martin Powers
Principal



RB/rgm

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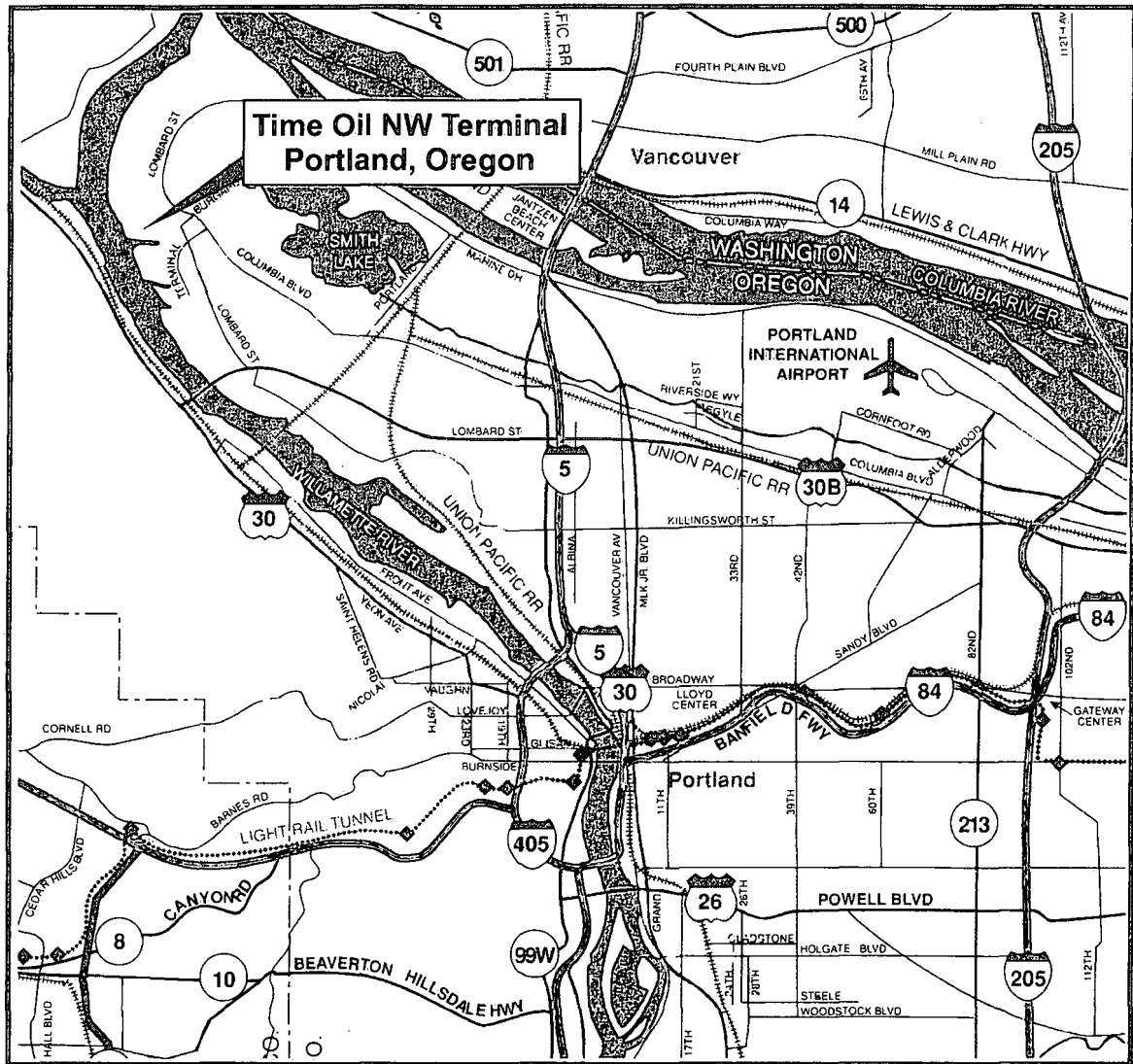
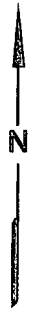
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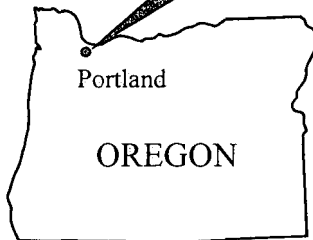
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Map from MetroAmerica 1995

SITE LOCATION
(see enlarged map area above)



Approximate Scale in Miles

Time Oil | T:23110011V:cmity Map.cdr (C) 6/20/2003



Time Oil NW Terminal
Portland, Oregon

Vicinity Map

Figure
1

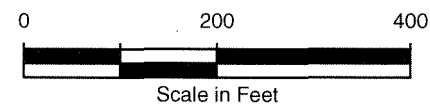
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Legend

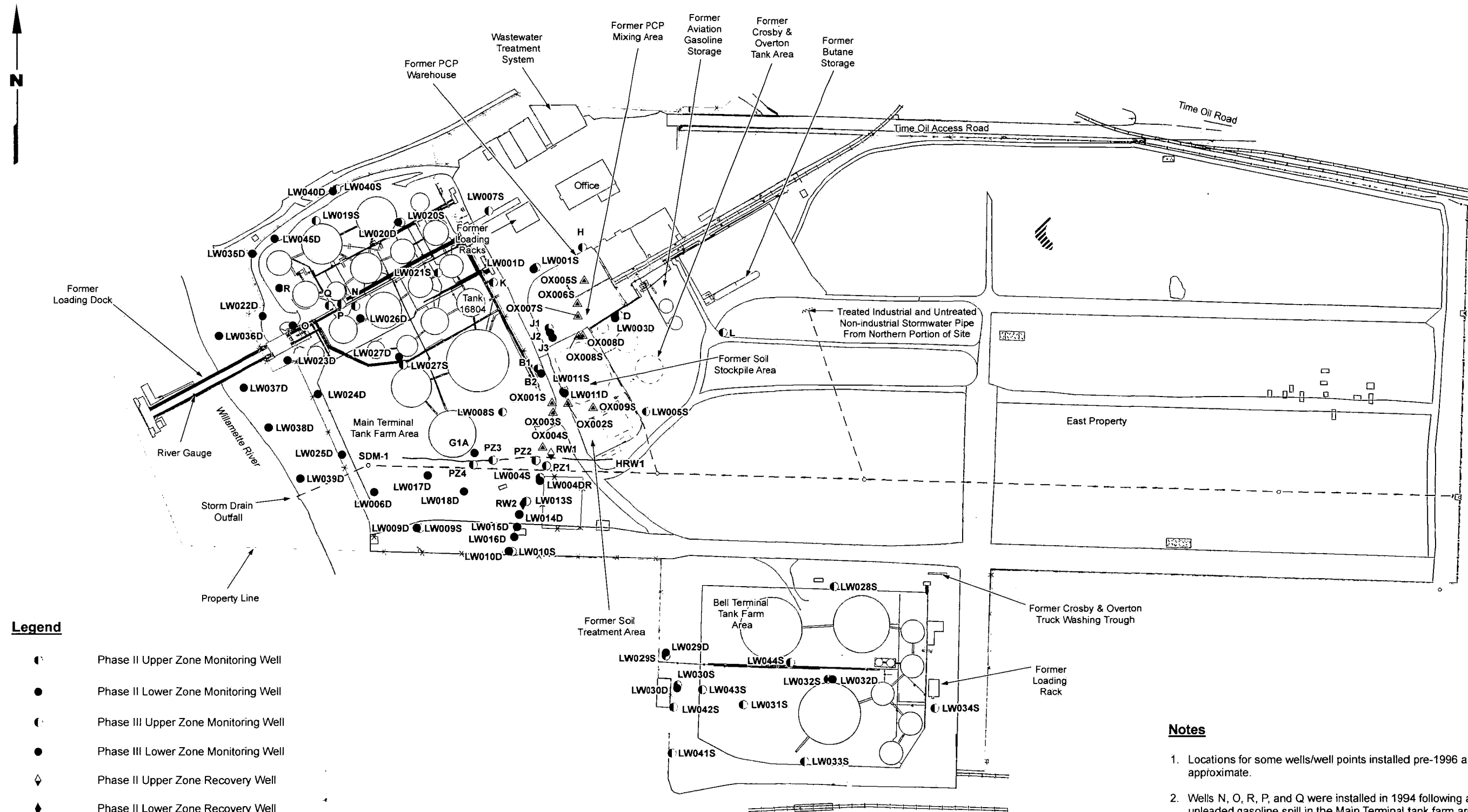
- Manhole
- Storm Drain
- Fence



Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

Terminal Map

Figure
2

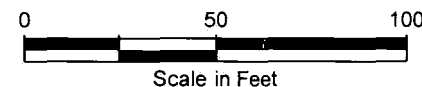


Legend

- Phase II Upper Zone Monitoring Well
- Phase II Lower Zone Monitoring Well
- Phase III Upper Zone Monitoring Well
- Phase III Lower Zone Monitoring Well
- ◆ Phase II Upper Zone Recovery Well
- ◆ Phase II Lower Zone Recovery Well
- ▲ Phase II ISCO Observation Well
- HRW1
Phase II Upper Zone Horizontal Recovery Well
(Dashes Denote Screened Interval)
- Phase III Study Area Boundary
- Storm Drain
- Manhole

Notes

1. Locations for some wells/well points installed pre-1996 are approximate.
2. Wells N, O, R, P, and Q were installed in 1994 following an unleaded gasoline spill in the Main Terminal tank farm area; wells are designated as Phase III because of location.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.



Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

**PCP Mixing Area Excavation
Boundaries and Summary of PCP
Concentrations Remaining in Soil**

Figure
4

Legend:

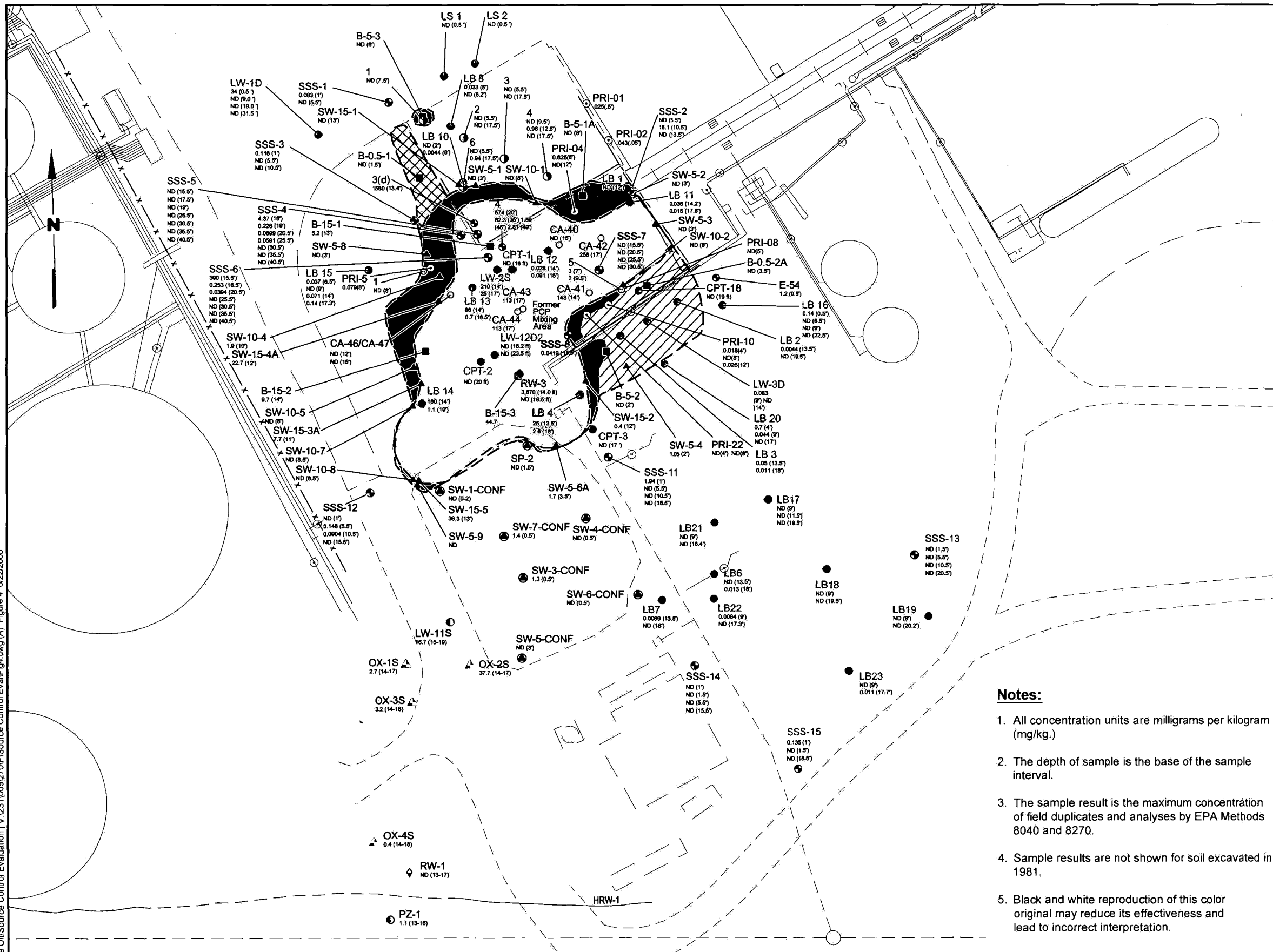
- Approximate Extent of Excavation from 0 - 5 ft BGS
- Approximate Extent of Excavation from 5 - 10 ft BGS
- Approximate Extent of Excavation from 10 - 13 ft BGS
- Approximate Extent of Excavation from 0 - 0.5 ft BGS
- Approximate Extent of Excavation from 0 - 2 ft BGS
- HRW-1 Horizontal Recovery Well - Upper Zone (Dashes Denote Screened Interval)
- Soil Data from Phase II RI
- Historical Soil Data (Ecova 1989)
- Historical Soil Data (Riedel 1985)
- Historical Soil Data (SRH 1986)
- Phase II Supplemental Sampling Data
- Pre-Removal Investigation Data
- ND Not Detected
- NA Not Analyzed
- Upper Zone Monitoring Well
- Upper Zone Recovery Well
- ISCO Pilot Test Monitoring Well
- Verification Sample Location (2002)
- Verification Soil Sample Location Base of Excavation (2002)
- Verification Soil Sample Location Side Wall of Excavation (2002)

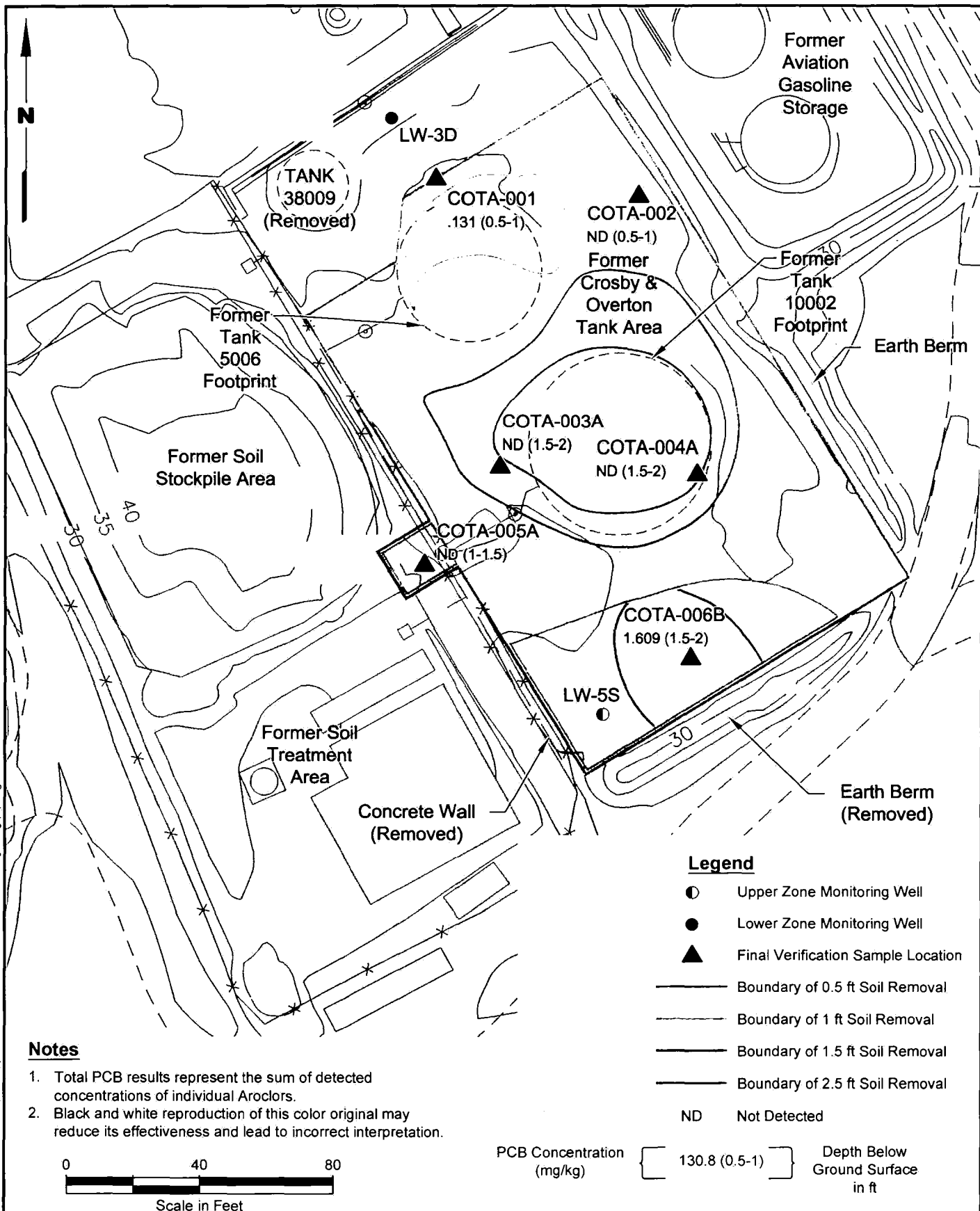
Notes:

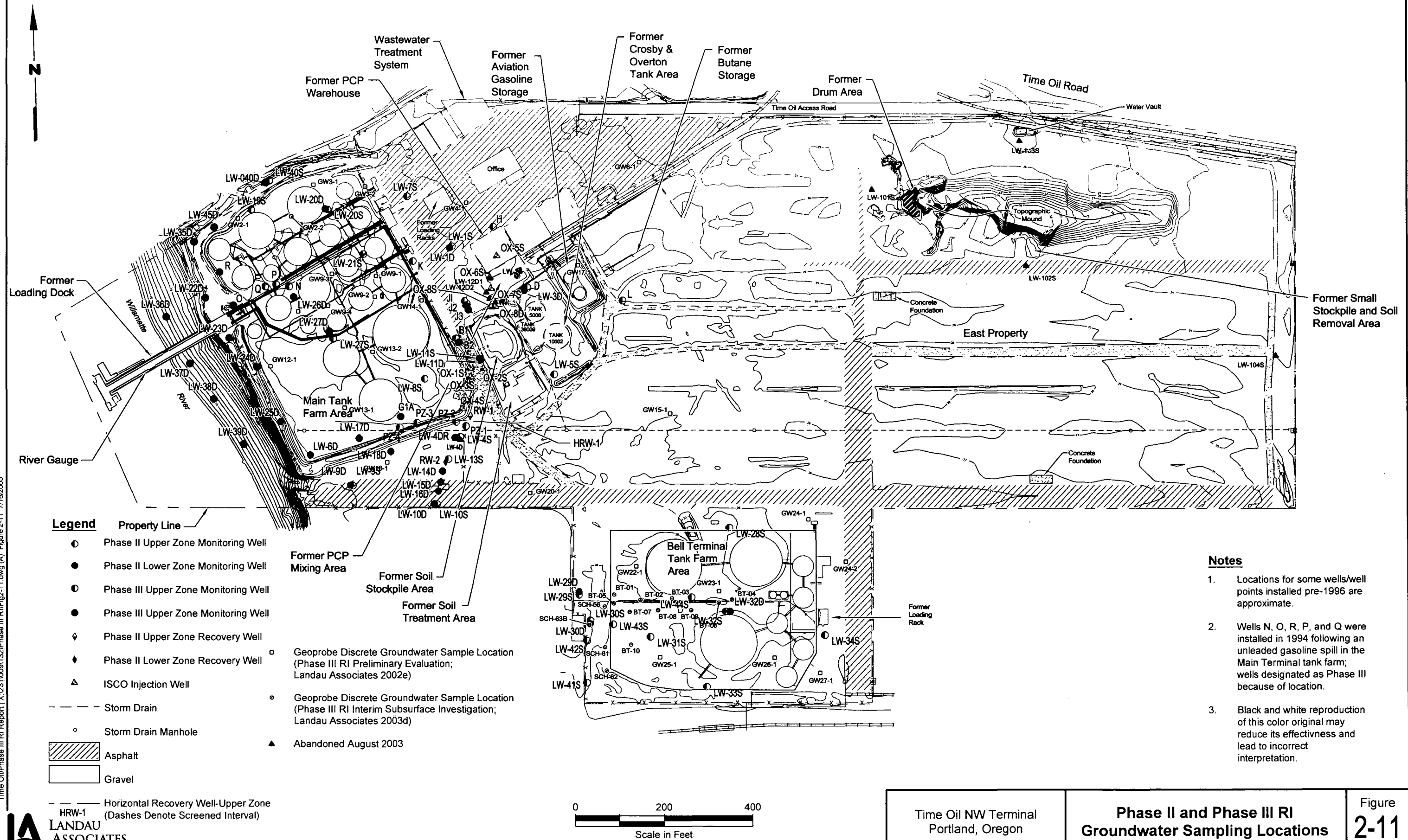
- All concentration units are milligrams per kilogram (mg/kg.)
- The depth of sample is the base of the sample interval.
- The sample result is the maximum concentration of field duplicates and analyses by EPA Methods 8040 and 8270.
- Sample results are not shown for soil excavated in 1981.
- Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

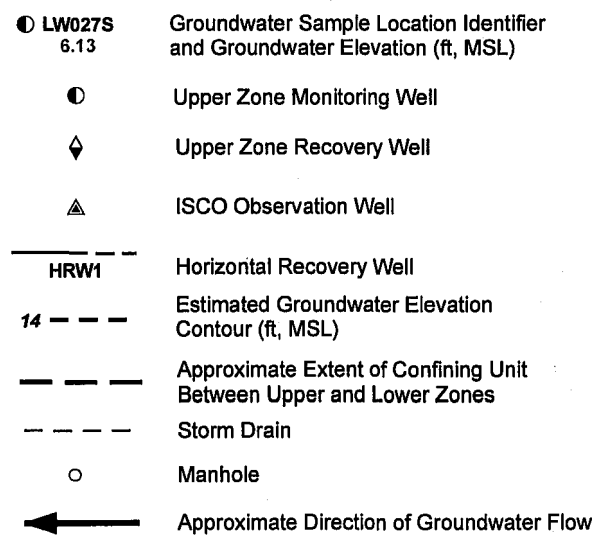
Location Identifier → LB 10

PCP Concentration (mg/kg) $\left\{ \begin{array}{l} \text{ND (2')} \\ 0.0044 (8') \end{array} \right\}$ Depths Below Ground Surface in ft



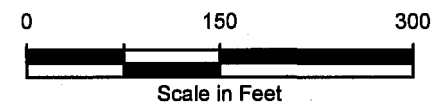






Notes

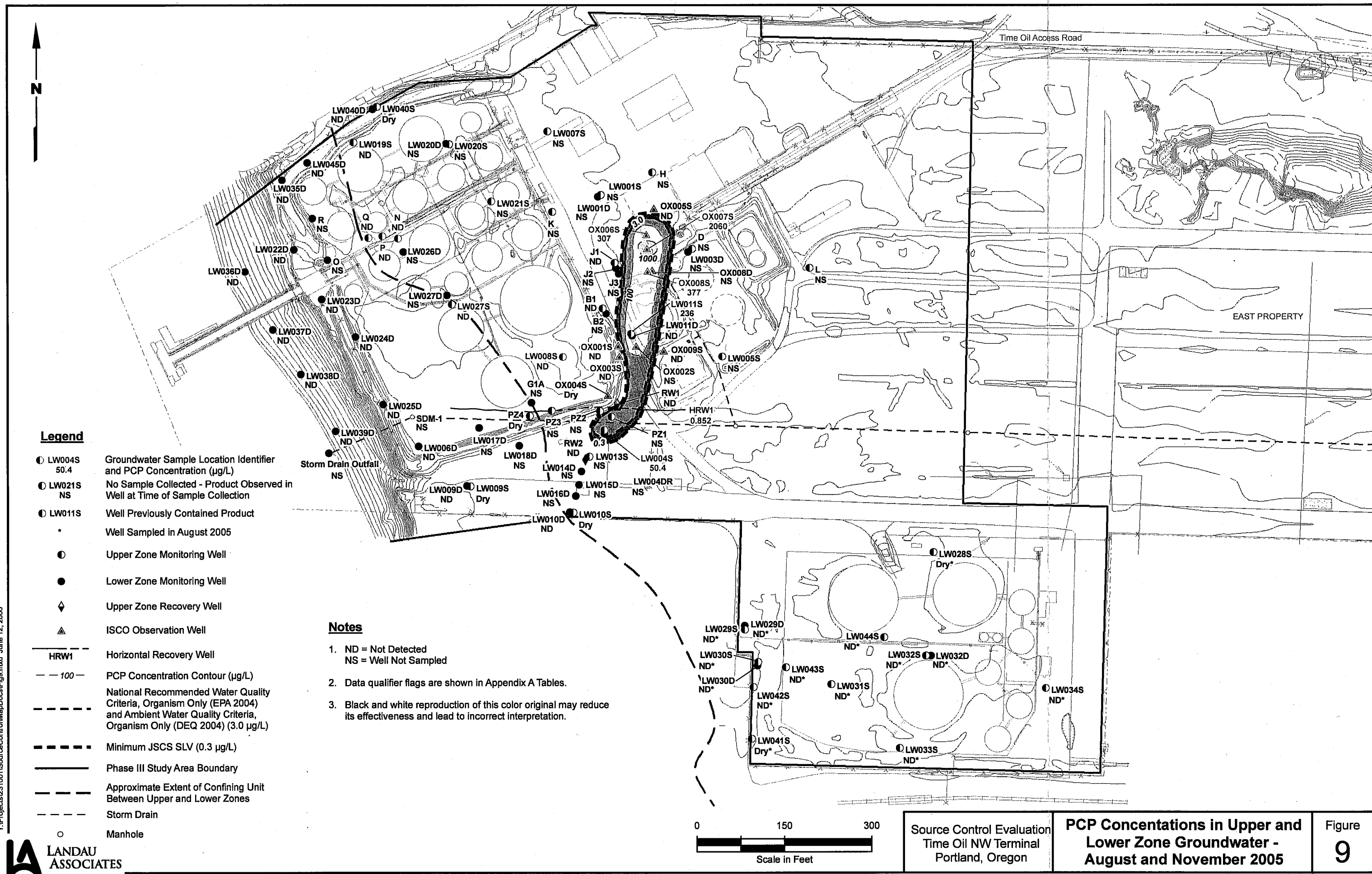
1. Groundwater levels measured on November 14, 2005
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

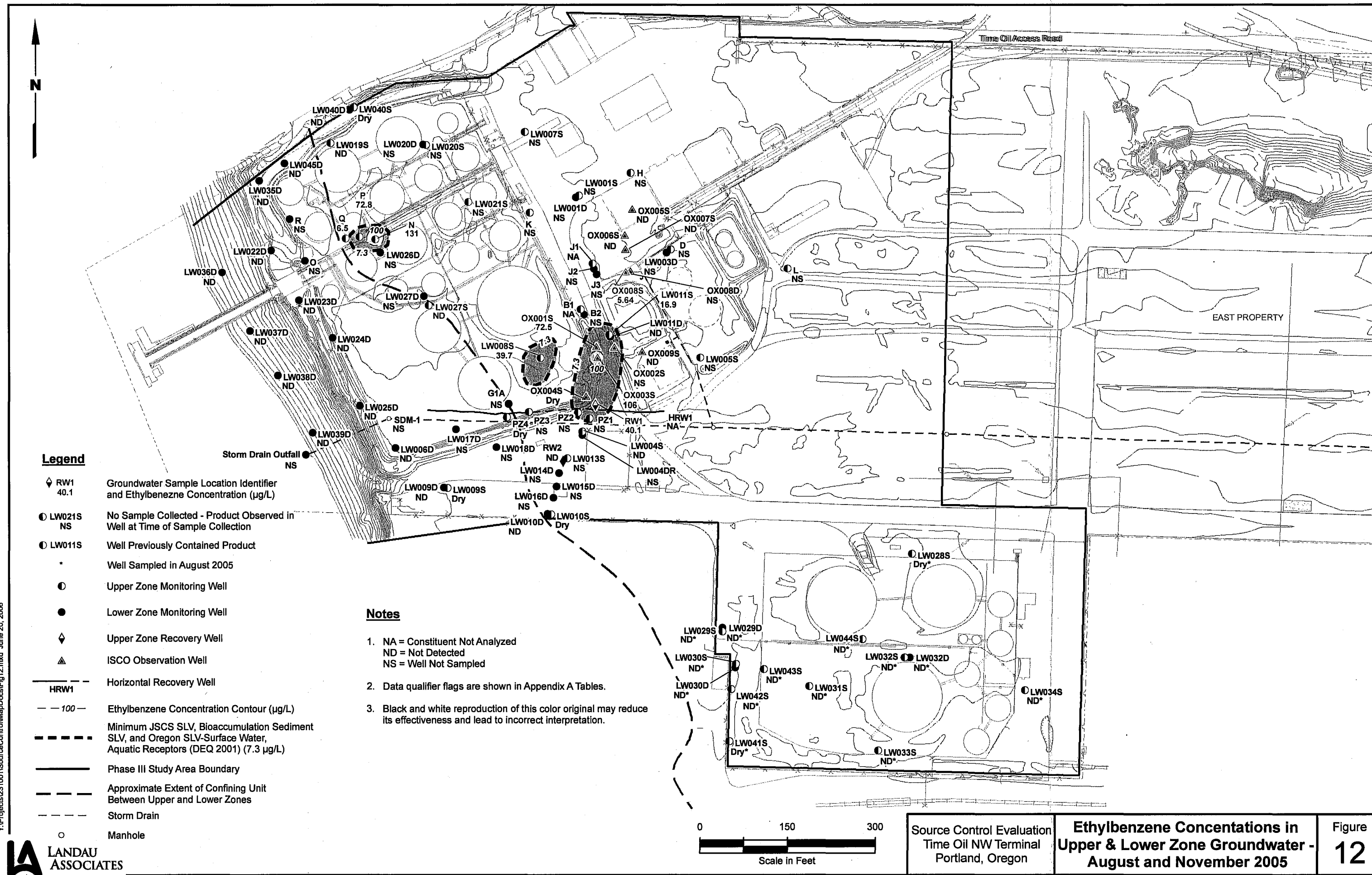


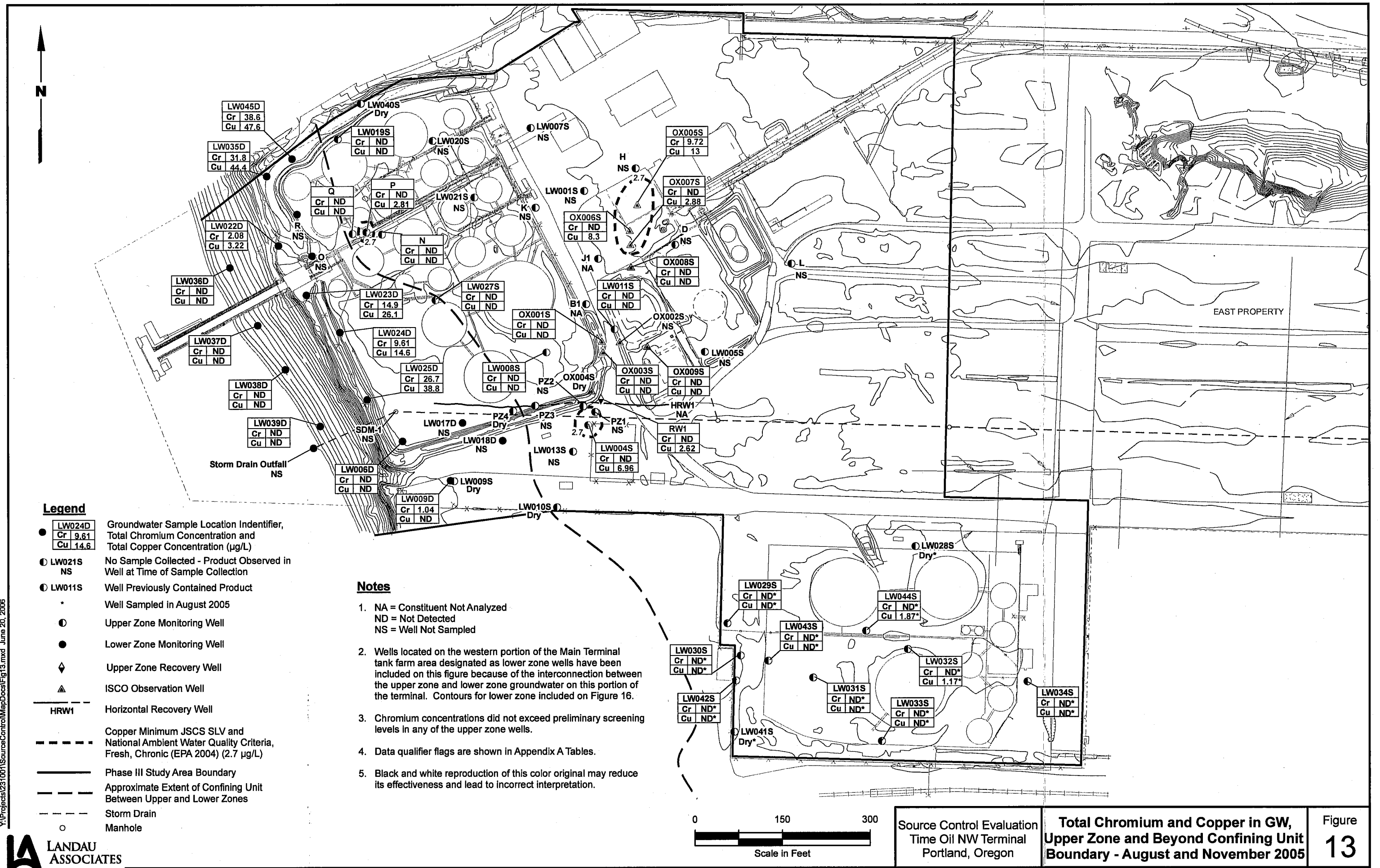
Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

**Groundwater Elevation Contours
Upper Zone - November 2005**

Figure 7





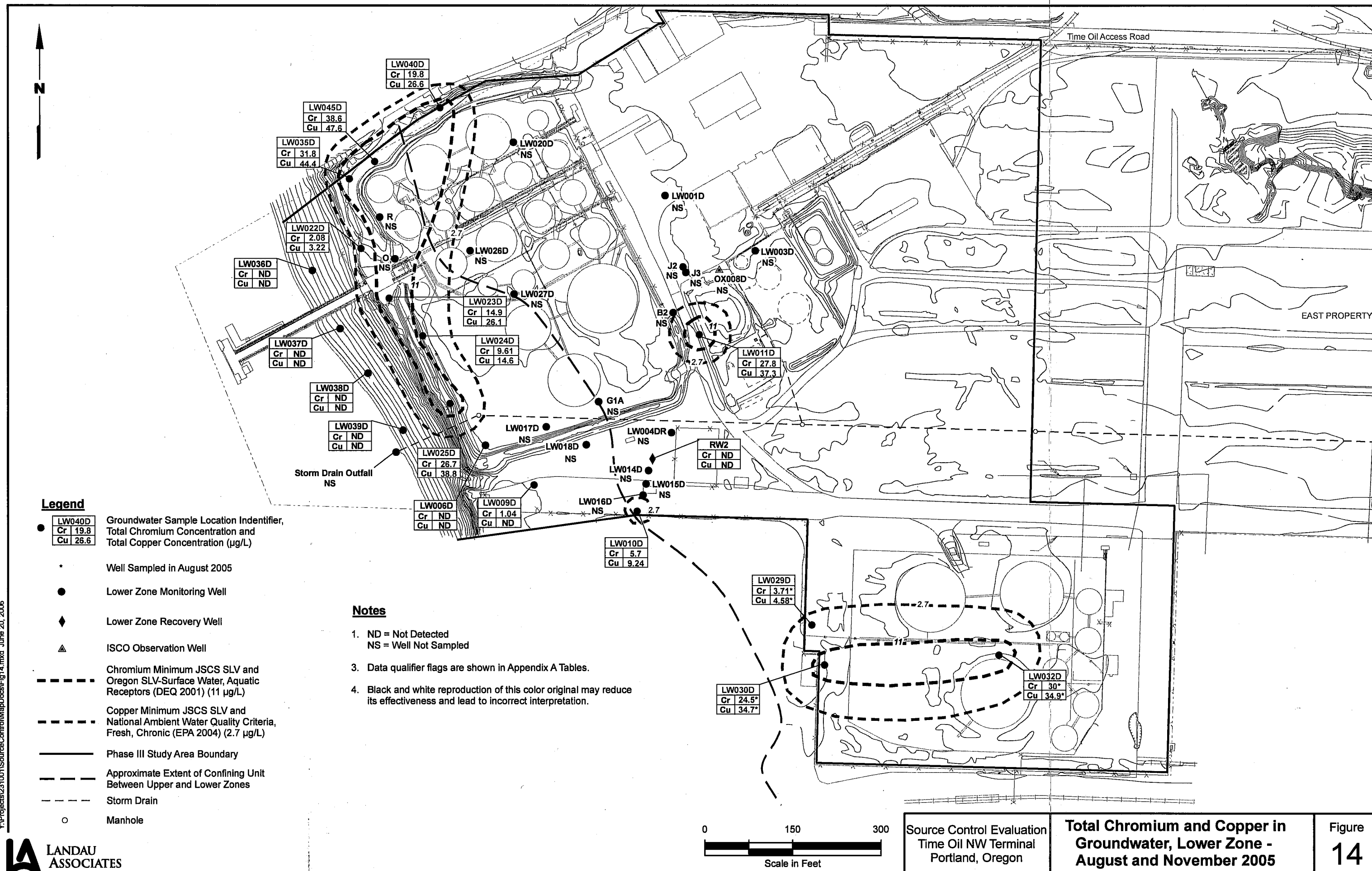


Legend

- LW040D
Cr 19.8
Cu 26.6
Groundwater Sample Location Identifier, Total Chromium Concentration and Total Copper Concentration (µg/L)
- * Well Sampled in August 2005
- Lower Zone Monitoring Well
- ◆ Lower Zone Recovery Well
- ▲ ISCO Observation Well
- Chromium Minimum JSCS SLV and Oregon SLV-Surface Water, Aquatic Receptors (DEQ 2001) (11 µg/L)
- Copper Minimum JSCS SLV and National Ambient Water Quality Criteria, Fresh, Chronic (EPA 2004) (2.7 µg/L)
- Phase III Study Area Boundary
- Approximate Extent of Confining Unit Between Upper and Lower Zones
- Storm Drain
- Manhole

Notes

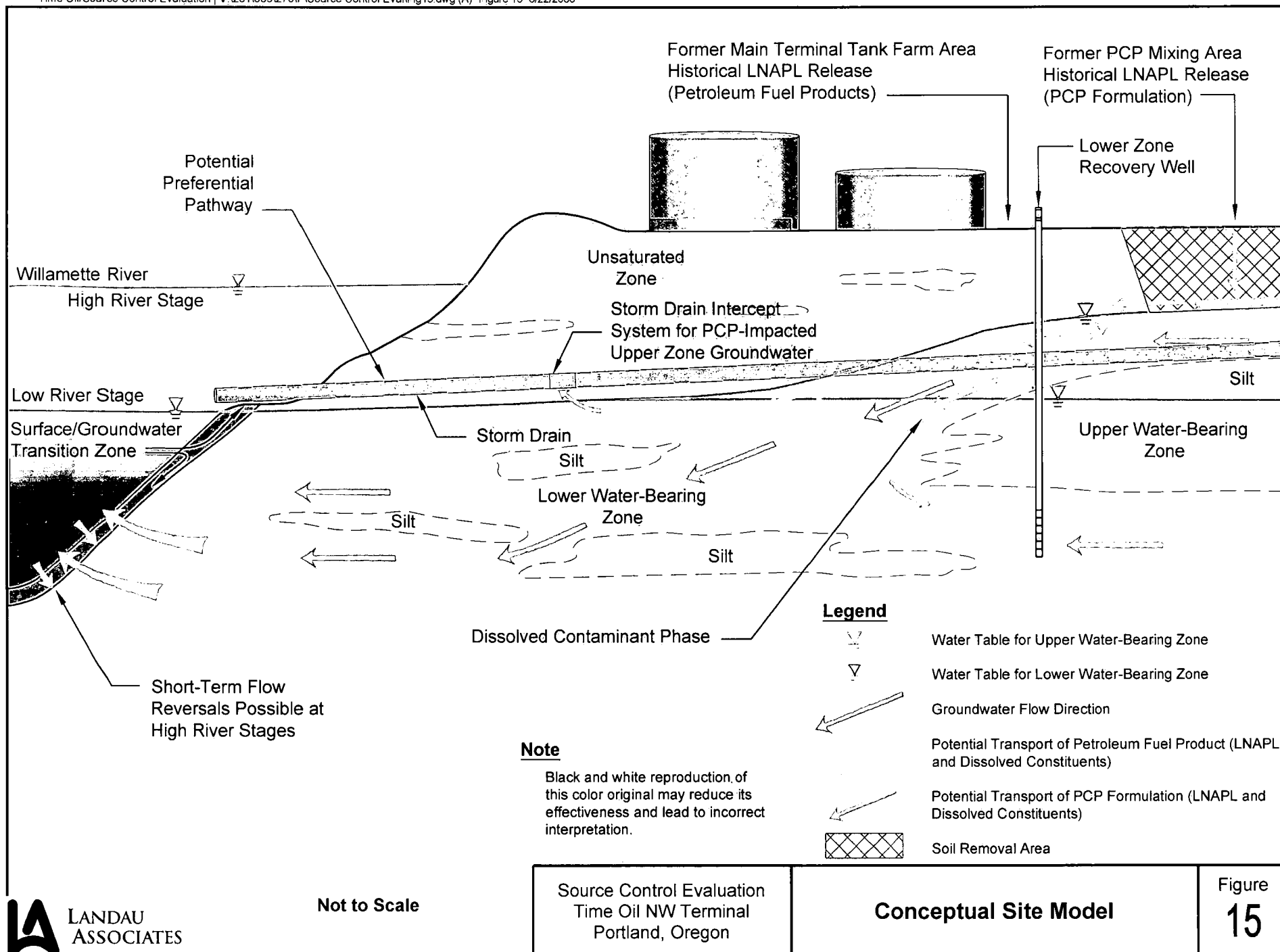
1. ND = Not Detected
NS = Well Not Sampled
3. Data qualifier flags are shown in Appendix A Tables.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

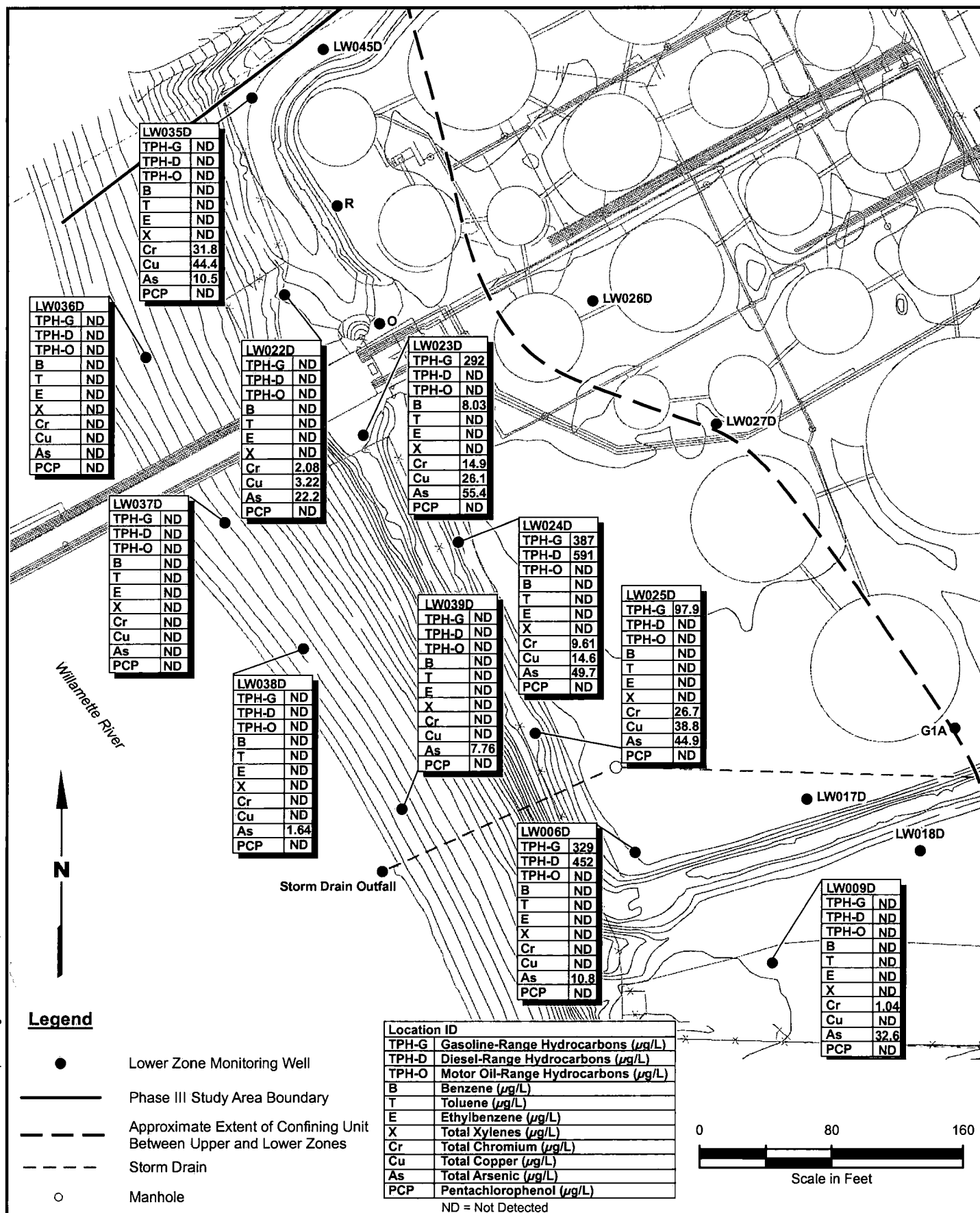


Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

Total Chromium and Copper in
Groundwater, Lower Zone -
August and November 2005

Figure
14



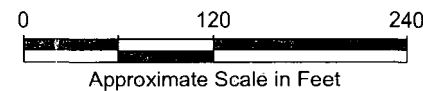
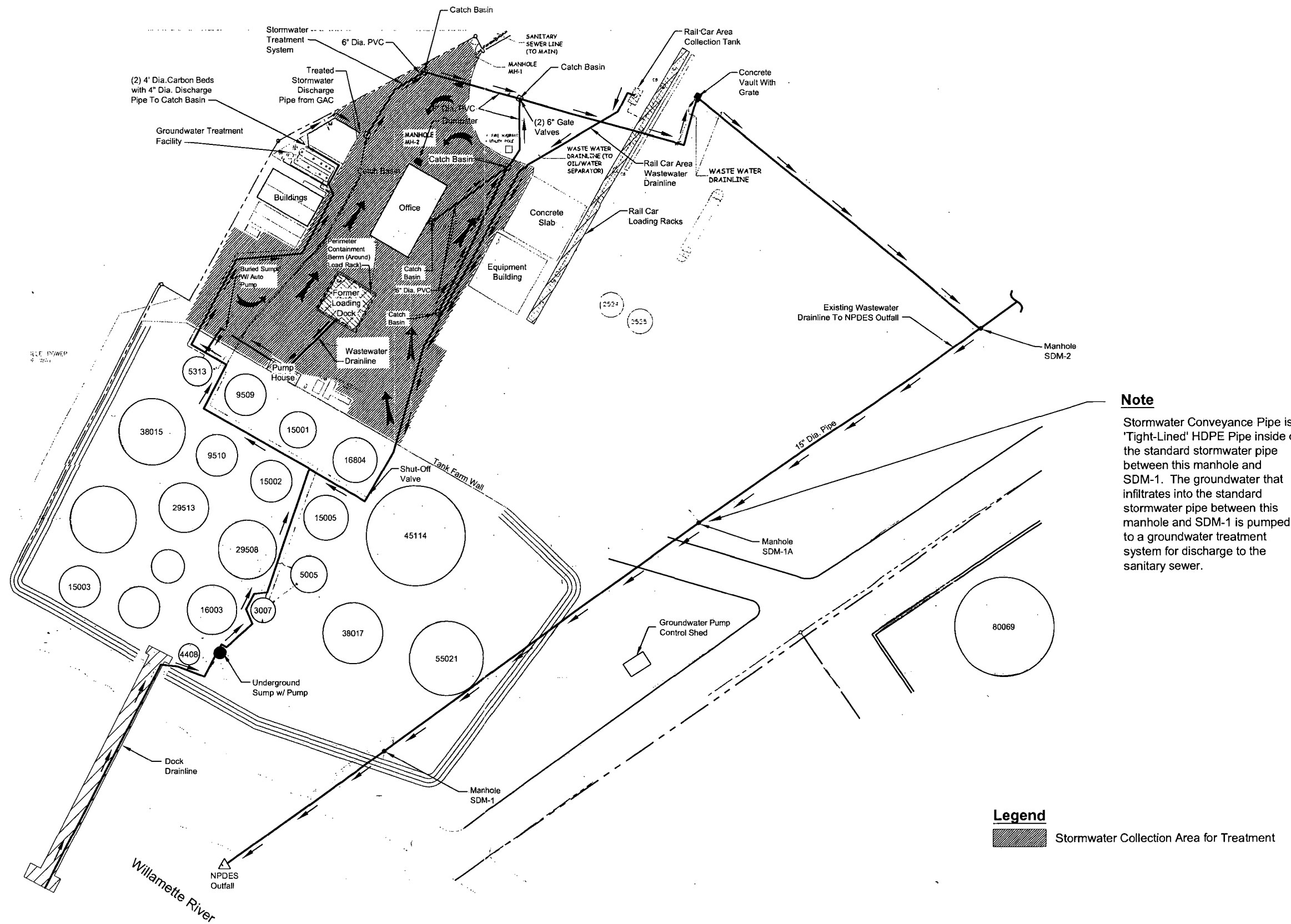


Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

**Groundwater Concentrations,
Nearshore Wells, Selected Analytes
November 2005**

Figure
16



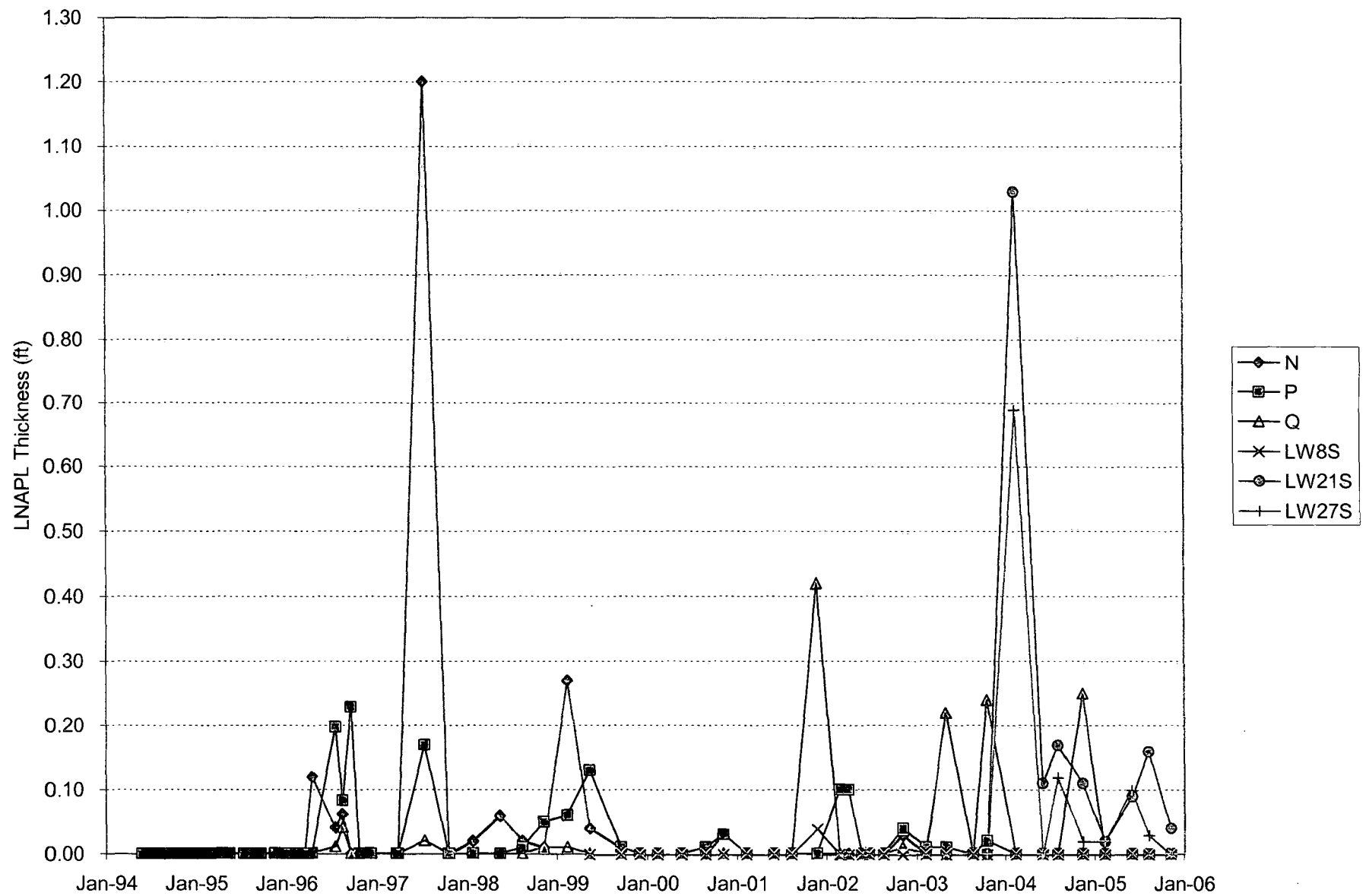


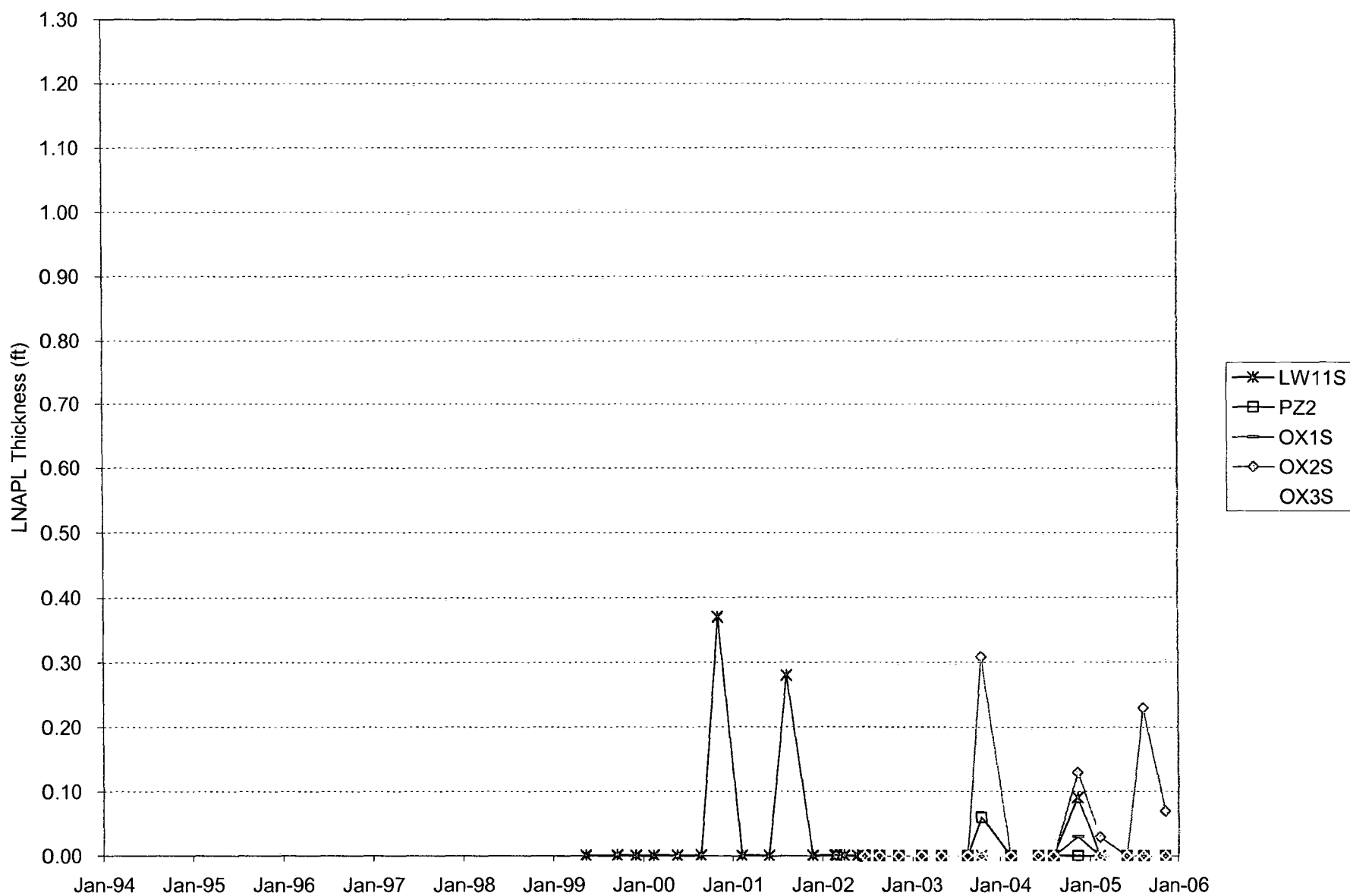
Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

Legend
Stormwater Collection Area for Treatment

**Stormwater Sewer System
Flow Route**

Figure
17



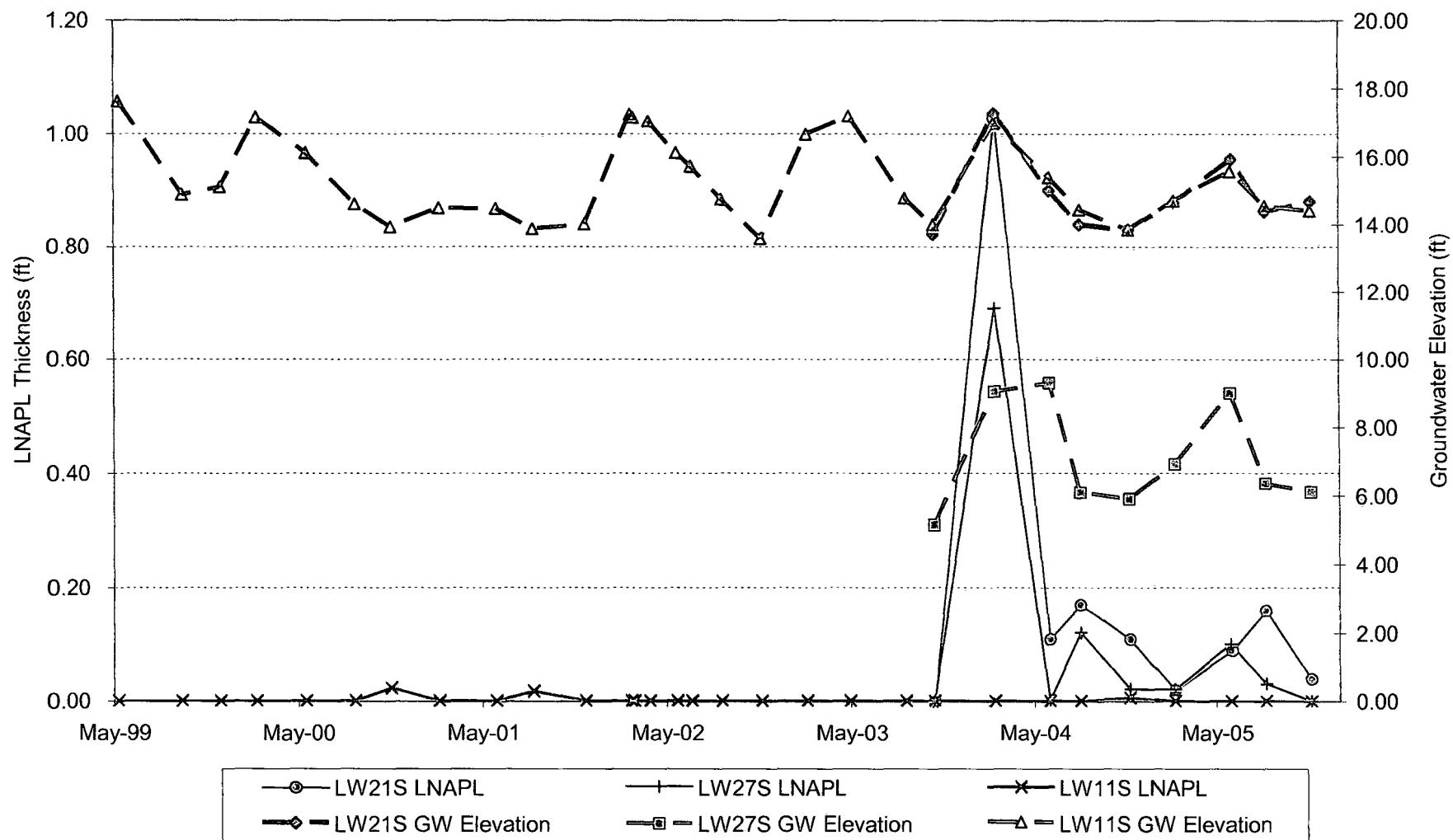


LANDAU
ASSOCIATES

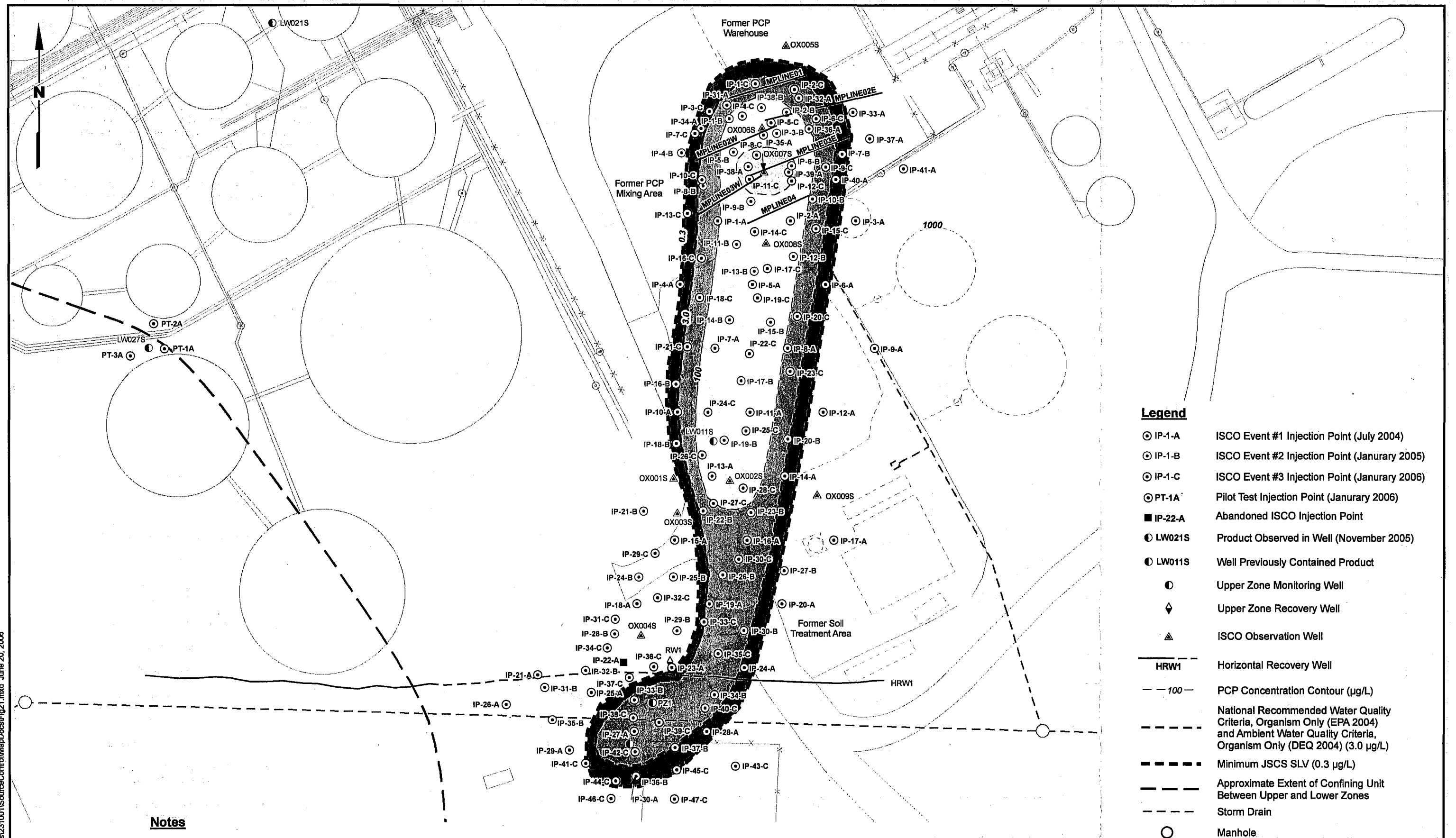
Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

**LNAPL Thickness vs. Time
Former PCP Mixing Area**

Figure
19



Y:\Projects\231001\SourceControl\MapDocs\Fig21.mxd June 20, 2006



Notes

1. Concentration of PCP in groundwater estimated from November 2005 sampling event.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

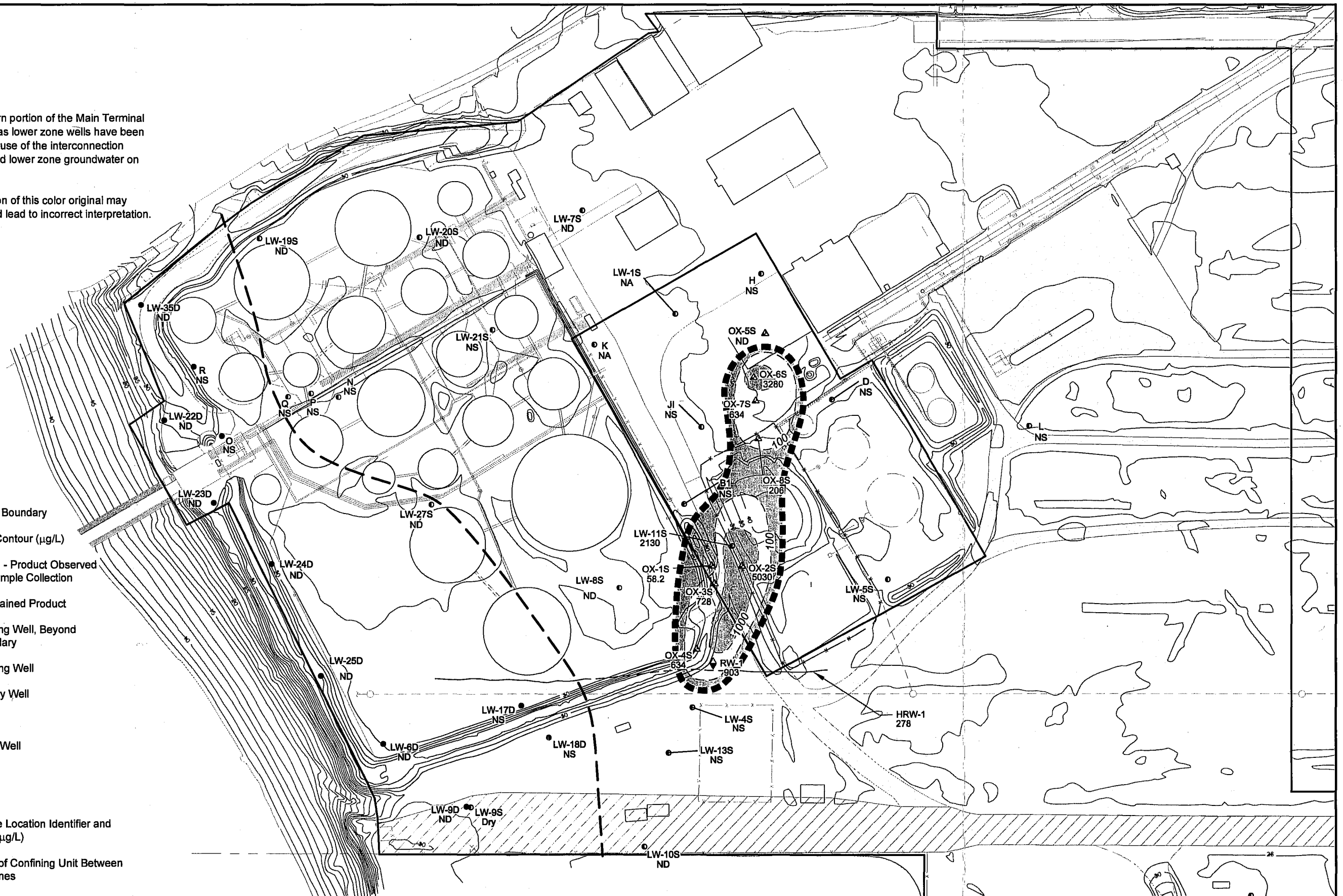
Notes

1. NA = Not Analyzed
ND = Not Detected
NS = Not Sampled
2. Wells located on the western portion of the Main Terminal tank farm area designated as lower zone wells have been included on this figure because of the interconnection between the upper zone and lower zone groundwater on this portion of the terminal.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Phase III Study Area Boundary
- 100 — PCP Concentration Contour ($\mu\text{g/L}$)
- LW-27S • No Sample Collected - Product Observed in Well at Time of Sample Collection
- LW-11S • Well Previously Contained Product
- Lower Zone Monitoring Well, Beyond Confining Unit Boundary
- Upper Zone Monitoring Well
- ◆ Upper Zone Recovery Well
- ▲ ISCO Injection Well
- HRW-1 Horizontal Recovery Well
- - - Storm Drain
- Manhole
- OX-1S 58.2 Groundwater Sample Location Identifier and PCP Concentration ($\mu\text{g/L}$)
- - - Approximate Extent of Confining Unit Between Upper and Lower Zones
- - - Minimum Preliminary Screening Level ($3.0 \mu\text{g/L}$; National Recommended Water Quality Criteria, Organism Only)

Time Oil/Source Control Evaluation | V:\231009\2701\Source Control Eval\Fig22.dwg (A) "Figure 22" 6/22/2006



Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

Upper Zone PCP Concentrations
in ISCO Injection Area
June 2004

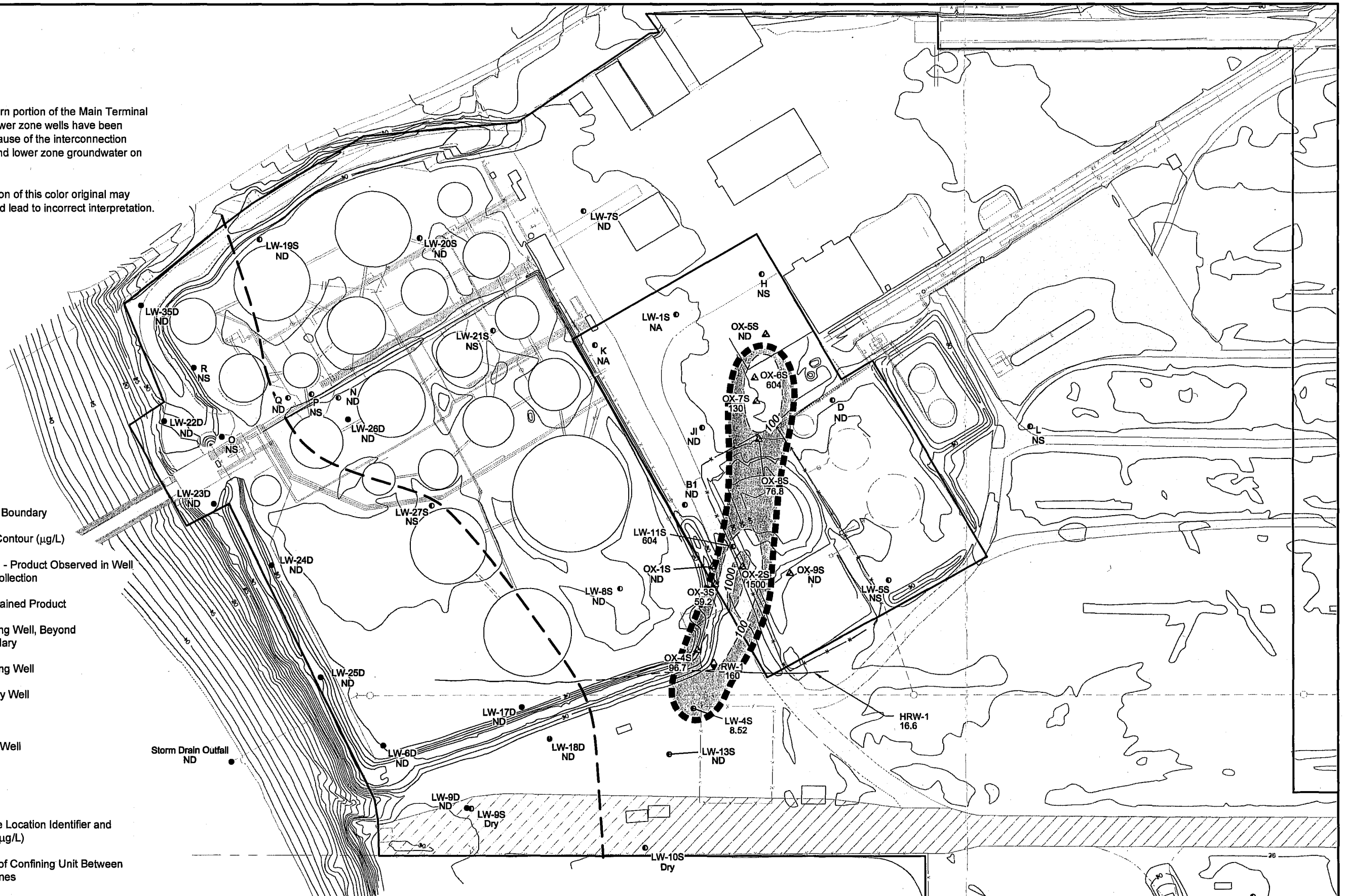
Figure
22

Notes

1. ND = Not Detected
NS = Not Sampled
2. Wells located on the western portion of the Main Terminal tank farm designated as lower zone wells have been included on this figure because of the interconnection between the upper zone and lower zone groundwater on this portion of the terminal.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Phase III Study Area Boundary
- - - 100 - PCP Concentration Contour (µg/L)
- LW-27S
● No Sample Collected - Product Observed in Well at Time of Sample Collection
- LW-11S
● Well Previously Contained Product
- Lower Zone Monitoring Well, Beyond Confining Unit Boundary
- Upper Zone Monitoring Well
- ◆ Upper Zone Recovery Well
- ▲ ISCO Injection Well
- HRW-1
— Horizontal Recovery Well
- Storm Drain
- Manhole
- LW-4S
8.52
Groundwater Sample Location Identifier and PCP Concentration (µg/L)
- - - Approximate Extent of Confining Unit Between Upper and Lower Zones
- - - Minimum Preliminary Screening Level (3.0 µg/L; National Recommended Water Quality Criteria, Organism Only)



0 100 200
Scale in Feet

Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

Upper Zone PCP Concentrations
in ISCO Injection Area
August 2004

Figure
23

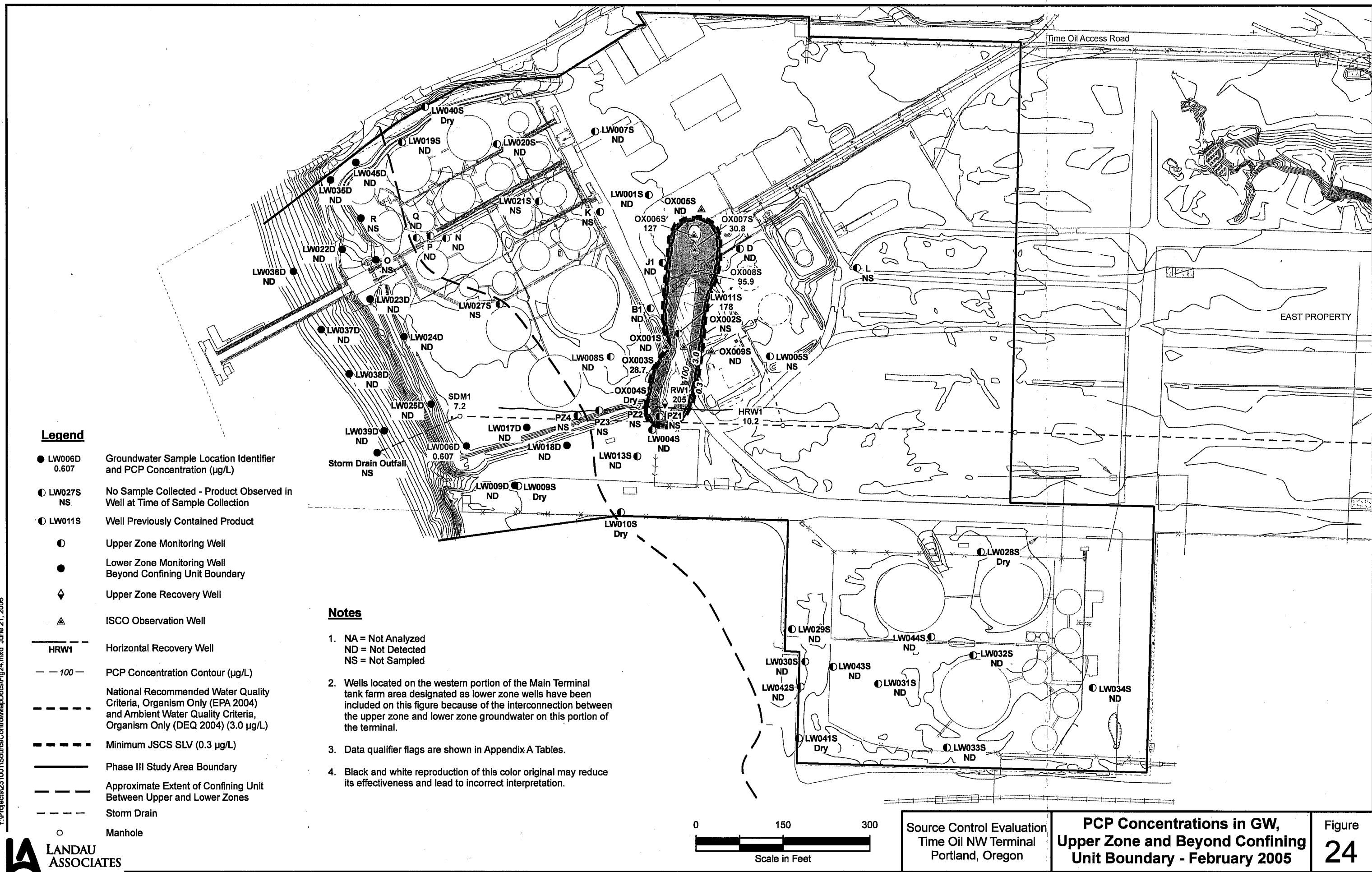


TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	B1 P5K0699-02 11/15/2005	J1 P5K0699-06 11/15/2005	LW004S P5K0699-03 11/15/2005	LW008S P5K0699-04 11/15/2005	LW011S P5K0820-03 11/17/2005	OX001S P5K0699-10 11/16/2005	OX003S P5K0699-09 11/16/2005	OX005S P5K0699-07 11/15/2005	OX006S P5K0699-12 11/16/2005	OX007S P5K0699-13 11/16/2005	OX008S P5K0699-11 11/16/2005	OX009S P5K0699-08 11/15/2005
PENTACHLOROPHENOL (µg/L)												
EPA 8270SIM												
Pentachlorophenol (8270SIM)	0.495 U	0.481 U		2.43 U								
SEMIVOLATILES (µg/L)												
EPA 8270C												
2,3,4,6-Tetrachlorophenol			24.8 U	25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	38.8	100 U	5.00 U
Acenaphthene (8270)	4.95 UJ		5.00 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Acenaphthylene (8270)	4.95 UJ		5.00 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Anthracene (8270)	4.95 UJ		5.00 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Benzo(a)anthracene (8270)	4.95 UJ		5.00 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Benzo(a)pyrene (8270)	4.95 UJ		5.00 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Benzo(b)fluoranthene (8270)	4.95 UJ		5.00 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Benzo(g,h,i)perylene (8270)	4.95 UJ		5.00 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Benzo(k)fluoranthene (8270)	4.95 UJ		5.00 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Benzoic Acid	248 U		250 U	1250 U	101 U	204 U	50.5 U	2500 U	253 U	50.0 U	50.0 U	50.0 U
Benzyl alcohol	24.8 UJ		25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U	5.00 U
4-Bromophenyl-phenylether	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
Butyl benzyl phthalate	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
4-Chloro-3-methylphenol	9.90 U		10.0 U	50.0 U	4.04 U	8.16 U	2.02 U	100 U	10.1 U	2.00 U	2.00 U	2.00 U
4-Chloroaniline	14.9 UJ		15.0 U	75.0 U	6.06 U	12.2 U	3.03 U	150 U	15.2 U	3.00 U	3.00 U	3.00 U
Bis(2-chloroethoxy)methane	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
Bis(2-chloroethyl)ether	9.90 UJ		10.0 U	50.0 U	4.04 U	8.16 U	2.02 U	100 U	10.1 U	2.00 U	2.00 U	2.00 U
Bis(2-chloroisopropyl)ether	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
2-Chloronaphthalene	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
2-Chlorophenol	4.95 U		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
4-Chlorophenylphenyl ether	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
Chrysene (8270)	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
Di-n-butyl phthalate	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
Di-n-octyl phthalate	9.90 UJ		10.0 U	50.0 U	4.04 U	8.16 U	2.02 U	100 U	10.1 U	2.00 U	2.00 U	2.00 U
Dibenzo(a,h)anthracene (8270)	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
Dibenzofuran (8270)	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
1,2-Dichlorobenzene (8270)	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
1,3-Dichlorobenzene (8270)	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
1,4-Dichlorobenzene (8270)	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
3,3-Dichlorobenzidine	49.5 UJ		50.0 U	250 U	20.2 U	40.8 U	10.1 U	500 U	50.5 U	10.0 U	10.0 U	10.0 U
2,4-Dichlorophenol	14.9 U		15.0 U	75.0 U	6.06 U	12.2 U	3.03 U	150 U	15.2 U	3.00 U	3.00 U	3.00 U
Diethyl phthalate	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
2,4-Dimethylphenol	14.9 U		15.0 U	75.0 U	6.06 U	12.2 U	3.03 U	150 U	15.2 U	3.00 U	3.00 U	3.00 U
Dimethyl phthalate	4.95 UJ		5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U	1.00 U
4,6-Dinitro-2-methylphenol	74.3 U		75.0 U	375 U	30.3 U	61.2 U	15.2 U	750 U	75.8 U	15.0 U	15.0 U	15.0 U
2,4-Dinitrophenol	124 U		125 U	625 U	50.5 U	102 U	25.3 U	1250 U	126 U	25.0 U	25.0 U	25.0 U
2,4-Dinitrotoluene	24.8 UJ		25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U	5.00 U

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	B1 P5K0699-02 11/15/2005	J1 P5K0699-06 11/15/2005	LW004S P5K0699-03 11/15/2005	LW008S P5K0699-04 11/15/2005	LW011S P5K0820-03 11/17/2005	OX001S P5K0699-10 11/16/2005	OX003S P5K0699-09 11/16/2005	OX005S P5K0699-07 11/15/2005	OX006S P5K0699-12 11/16/2005	OX007S P5K0699-13 11/16/2005	OX008S P5K0699-11 11/16/2005	OX009S P5K0699-08 11/15/2005
2,6-Dinitrotoluene			24.8 UJ	25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U
Bis(2-ethylhexyl)phthalate			49.5 UJ	50.0 U	250 U	20.2 U	40.8 U	10.1 U	500 U	50.5 U	10.0 U	10.0 U
Fluoranthene (8270)			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Fluorene (8270)			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Hexachlorobenzene			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Hexachlorobutadiene (8270)			9.90 UJ	10.0 U	50.0 U	4.04 U	8.16 U	2.02 U	100 U	10.1 U	2.00 U	2.00 U
Hexachlorocyclopentadiene			24.8 UJ	25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U
Hexachloroethane			9.90 UJ	10.0 U	50.0 U	4.04 U	8.16 U	2.02 U	100 U	10.1 U	2.00 U	2.00 U
Indeno(1,2,3-cd)pyrene (8270)			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Isophorone			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
2-Methylnaphthalene (8270)			4.95 UJ	10.8	25.0 U	4.14	5.27	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
2-Methylphenol			4.95 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
3- & 4-Methylphenol			4.95 U	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Naphthalene (8270)			4.95 UJ	24.6	25.0 U	8.32	11.7	1.01 U	50.0 U	5.05 U	1.27	1.00 U
2-Nitroaniline			24.8 UJ	25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U
3-Nitroaniline			29.7 UJ	30.0 U	150 U	12.1 U	24.5 U	6.06 U	300 U	30.3 U	6.00 U	6.00 U
4-Nitroaniline			24.8 UJ	25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U
Nitrobenzene			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
2-Nitrophenol			24.8 U	25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U
4-Nitrophenol			24.8 U	25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U
N-Nitroso-Di-N-Propylamine			9.90 UJ	10.0 U	50.0 U	4.04 U	8.16 U	2.02 U	100 U	10.1 U	2.00 U	2.00 U
N-Nitrosodiphenylamine			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Pentachlorophenol (8270)			50.4	25.0 U	236	10.1 U	20.4 U	5.05 U	307	2060	377	5.00 U
Phenanthrene (8270)			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
Phenol			9.90 U	10.0 U	50.0 UJ	4.04 U	8.16 UJ	2.02 U	100 UJ	10.1 UJ	2.00 UJ	2.00 U
Pyrene (8270)			4.95 UJ	5.00 UJ	25.0 U	2.02 UJ	4.08 U	1.01 UJ	50.0 U	5.05 U	1.00 U	1.00 UJ
1,2,4-Trichlorobenzene (8270)			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
2,4,5-Trichlorophenol			24.8 U	25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U
2,4,6-Trichlorophenol			24.8 U	25.0 U	125 U	10.1 U	20.4 U	5.05 U	250 U	25.3 U	5.00 U	5.00 U
Carbazole			4.95 UJ	5.00 U	25.0 U	2.02 U	4.08 U	1.01 U	50.0 U	5.05 U	1.00 U	1.00 U
PAHs (µg/L)												
EPA 8270SIM												
Acenaphthene (8270SIM)												
Acenaphthylene (8270SIM)												
Anthracene (8270SIM)												
Benzo(a)anthracene (8270SIM)												
Benzo(a)pyrene (8270SIM)												
Benzo(b)fluoranthene (8270SIM)												
Benzo(g,h,i)perylene (8270SIM)												
Benzo(k)fluoranthene (8270SIM)												
Chrysene (8270SIM)												
Dibenzo(a,h)anthracene (8270SIM)												

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	B1 P5K0699-02 11/15/2005	J1 P5K0699-06 11/15/2005	LW004S P5K0699-03 11/15/2005	LW008S P5K0699-04 11/15/2005	LW011S P5K0820-03 11/17/2005	OX001S P5K0699-10 11/16/2005	OX003S P5K0699-09 11/16/2005	OX005S P5K0699-07 11/15/2005	OX006S P5K0699-12 11/16/2005	OX007S P5K0699-13 11/16/2005	OX008S P5K0699-11 11/16/2005	OX009S P5K0699-08 11/15/2005
Fluoranthene (8270SIM)												
Fluorene (8270SIM)												
Indeno(1,2,3-cd)pyrene (8270SIM)												
Naphthalene (8270SIM)												
Phenanthrene (8270SIM)												
Pyrene (8270SIM)												
VOLATILES (µg/L)												
EPA 8260B												
Acetone			25.0 U	50.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Benzene			1.00 U	2.00 U	2.66	31	43.3	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromobenzene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromochloromethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromodichloromethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromoform			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromomethane			5.00 U	10.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-Butanone			10.0 U	20.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
n-Butylbenzene			5.00 U	10.3	5.00 U	5.00 U	7.31	5.00 U	5.00 U	5.00 U	9.01	5.00 U
sec-Butylbenzene			1.00 U	23.5	3.69	6.31	7.18	1.00 U	1.81	3.51	17.7	1.00 U
tert-Butylbenzene			1.00 U	10.1	1.00 U	1.56	1.78	1.00 U	1.00 U	1.00 U	3.01	1.00 U
Carbon disulfide			10.0 U	20.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Carbon tetrachloride			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chlorobenzene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chloroethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chloroform			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chloromethane			5.00 U	10.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-Chlorotoluene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
4-Chlorotoluene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dibromo-3-chloropropane			5.00 U	10.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Dibromochloromethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dibromoethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Dibromomethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dichlorobenzene (8260)			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,3-Dichlorobenzene (8260)			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,4-Dichlorobenzene (8260)			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Dichlorodifluoromethane			5.00 U	10.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,1-Dichloroethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dichloroethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-Dichloroethene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
cis-1,2-Dichloroethene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
trans-1,2-Dichloroethene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dichloropropane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,3-Dichloropropane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	B1 P5K0699-02 11/15/2005	J1 P5K0699-06 11/15/2005	LW004S P5K0699-03 11/15/2005	LW008S P5K0699-04 11/15/2005	LW011S P5K0820-03 11/17/2005	OX001S P5K0699-10 11/16/2005	OX003S P5K0699-09 11/16/2005	OX005S P5K0699-07 11/15/2005	OX006S P5K0699-12 11/16/2005	OX007S P5K0699-13 11/16/2005	OX008S P5K0699-11 11/16/2005	OX009S P5K0699-08 11/15/2005
2,2-Dichloropropane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-Dichloropropene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
cis-1,3-Dichloropropene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
trans-1,3-Dichloropropene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Ethylbenzene			1.00 U	39.7	16.9	72.5	106	1.00 U	1.00 U	1.00 U	5.64	1.00 U
Hexachlorobutadiene (8260)			4.00 U	8.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
2-Hexanone			10.0 U	20.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Isopropylbenzene			2.00 U	267	8.79	27.6	33.8	2.00 U	2.00 U	2.19	17.3	2.00 U
4-Isopropyltoluene			2.00 U	4.00 U	2.34	4.19	5.68	2.00 U	2.00 U	2.00 U	6.02	2.00 U
4-Methyl-2-Pentanone (MIBK)			5.00 U	10.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Methyl tert-butyl ether			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Methylene chloride			5.00 U	10.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Naphthalene (8260)			2.00 U	42.1	7.05	17.8	20.4	2.00 U	2.00 U	2.00 U	4.64	2.00 U
n-Propylbenzene			1.00 U	196	11.9	33.8	42.5	1.00 U	1.00 U	2.14	23.2	1.00 U
Styrene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,1,2-Tetrachloroethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,1,2,2-Tetrachloroethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Tetrachloroethene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Toluene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,3-Trichlorobenzene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,4-Trichlorobenzene (8260)			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,1-Trichloroethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-Trichloroethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Trichloroethene			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Trichlorofluoromethane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,3-Trichloropropane			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,4-Trimethylbenzene			1.00 U	2.00 U	37.1	136	173	1.00 U	1.00 U	9.1	146	1.00 U
1,3,5-Trimethylbenzene			1.00 U	2.00 U	4.02	33	44.8	1.00 U	1.00 U	1.00 U	22.2	1.00 U
Vinyl chloride			1.00 U	2.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
o-Xylene			1.00 U	2.00 U	20.4	9.61	83.7	1.00 U	1.00 U	1.52	20.1	1.00 U
m,p-Xylene			2.00 U	4.00 U	15.4	96.3	104	2.00 U	2.00 U	2.00 U	4.65	2.00 U

NWTPH-G (µg/L)

Gasoline Range Hydrocarbons	80.0 U	2860	739 J
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NWTPH-Dx (µg/L)

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	B1 P5K0699-02 11/15/2005	J1 P5K0699-06 11/15/2005	LW004S P5K0699-03 11/15/2005	LW008S P5K0699-04 11/15/2005	LW011S P5K0820-03 11/17/2005	OX001S P5K0699-10 11/16/2005	OX003S P5K0699-09 11/16/2005	OX005S P5K0699-07 11/15/2005	OX006S P5K0699-12 11/16/2005	OX007S P5K0699-13 11/16/2005	OX008S P5K0699-11 11/16/2005	OX009S P5K0699-08 11/15/2005
Diesel Range Hydrocarbons			250 U	1390	396							
Heavy Oil Range Hydrocarbons			500 U	495 U	481 U							
TOTAL METALS (µg/L)												
EPA 6020/7470A												
Antimony			1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Arsenic			1.00 U	30.4	3.16	18.1	14.1	15.7	5.98	2.94	27	2.35
Beryllium			1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Cadmium			1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chromium			1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	9.72	1.00 U	1.00 U	1.00 U	1.00 U
Copper			6.96	2.00 U	2.00 U	2.00 U	2.00 U	13	8.3	2.88	2.00 U	2.00 U
Lead			1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	4.78	1.00 U	1.00 U	1.00 U	1.00 U
Mercury			0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.355	0.200 U	0.200 U	0.200 U	0.200 U
Nickel			18.9	8.77	44.8	27.8	23.8	12.3	41.5	80.6	154	14.5
Selenium			2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Silver			1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Thallium			1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Zinc			5.00 U	9.34	5.00 U	5.00 U	5.00 U	37.8	11.3	7.88	12.2	5.00 U
DISSOLVED METALS (µg/L)												
EPA 6020												
Antimony (Dissolved)												
Arsenic (Dissolved)												
Beryllium (Dissolved)												
Cadmium (Dissolved)												
Chromium (Dissolved)												
Copper (Dissolved)												
Lead (Dissolved)												
Nickel (Dissolved)												
Selenium (Dissolved)												
Silver (Dissolved)												
Thallium (Dissolved)												
Zinc (Dissolved)												
DIOXINS AND FURANS (ng/L)												
EPA 1613B												
2,3,7,8-TCDF						0.00992 U			0.00986 U			
Total TCDF						0.00992 U			0.00986 U			
2,3,7,8-TCDD						0.00992 U			0.00986 U			
Total TCDD						0.00992 U			0.00986 U			
1,2,3,7,8-PeCDF						0.0496 U			0.0493 U			
2,3,4,7,8-PeCDF						0.0496 U			0.0493 U			
Total PeCDF						0.0496 U			0.0493 U			

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	B1 P5K0699-02 11/15/2005	J1 P5K0699-06 11/15/2005	LW004S P5K0699-03 11/15/2005	LW008S P5K0699-04 11/15/2005	LW011S P5K0820-03 11/17/2005	OX001S P5K0699-10 11/16/2005	OX003S P5K0699-09 11/16/2005	OX005S P5K0699-07 11/15/2005	OX006S P5K0699-12 11/16/2005	OX007S P5K0699-13 11/16/2005	OX008S P5K0699-11 11/16/2005	OX009S P5K0699-08 11/15/2005
1,2,3,7,8-PeCDD						0.0496 U			0.0493 U			
Total PeCDD						0.0496 U			0.0493 U			
1,2,3,4,7,8-HxCDF						0.0496 U			0.0493 U			
1,2,3,6,7,8-HxCDF						0.0496 U			0.0493 U			
2,3,4,6,7,8-HxCDF						0.0496 U			0.0493 U			
1,2,3,7,8,9-HxCDF						0.0496 U			0.0493 U			
Total HxCDF						0.0496 U			0.214			
1,2,3,4,7,8-HxCDD						0.0496 U			0.0493 U			
1,2,3,6,7,8-HxCDD						0.0496 U			0.0493 U			
1,2,3,7,8,9-HxCDD						0.0496 U			0.0493 U			
Total HxCDD						0.0496 U			0.0493 U			
1,2,3,4,6,7,8-HpCDF						0.204			0.434			
1,2,3,4,7,8,9-HpCDF						0.0496 U			0.0493 U			
Total HpCDF						0.525			1.04			
1,2,3,4,6,7,8-HpCDD						0.567			0.949			
Total HpCDD						0.851			1.42			
OCDF						0.354			0.551			
OCDD						4.29			5.1			
Total TEQ						0.012354			0.019481			
FIELD PARAMETERS												
pH	6.56	6.66	6.78	7.10	7.30	5.95	7.21	6.73	6.10	7.03	7.20	6.91
Temperature (deg C)	15.4	15.8	15.0	15.0	15.5	14.9	14.8	15.6	15.6	16.0	1.6	15.7
Conductivity (uS/cm)	230	219	17.4	377	363	238	371	193	216	334	530	411
Dissolved oxygen (mg/l)	2.93	1.16	4.06	2.95	2.19		2.96	1.42		3.65	2.97	3.27
Turbidity (NTU)	5	6	0	1		0	0	3	0	0	0	0
Ferrous Iron (mg/L)					2.4	5.4	2.7	6.5	4.0	2.5	4.0	2.1

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	RW1	Dup of RW1		LW019S	LW027S	N	P	Q	LW006D	LW009D	LW010D	LW011D	RW2
	P5K0820-02 11/17/2005	W P5K0820-01 11/17/2005	P5K0698-06 11/16/2005	P5K0819-04 11/17/2005	P5K0819-03 11/17/2005	P5K0819-02 11/17/2005	P5K0819-01 11/17/2005	P5K0820-06 11/17/2005	P5K0820-05 11/17/2005	P5K0699-01 11/14/2005	P5K0820-04 11/17/2005	P5K0699-05 11/15/2005	
PENTACHLOROPHENOL (µg/L)													
EPA 8270SIM													
Pentachlorophenol (8270SIM)	0.481 U	0.524							0.485 U	0.505 U	0.485 U	0.490 U	0.476 U
SEMIVOLATILES (µg/L)													
EPA 8270C													
2,3,4,6-Tetrachlorophenol	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U	
Acenaphthene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	6.17	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Acenaphthylene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Anthracene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Benzo(a)anthracene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Benzo(a)pyrene (8270)	4.85 U	4.81 U	20.0 U	9.62 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Benzo(b)fluoranthene (8270)	4.85 U	4.81 U	20.0 U	9.62 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Benzo(g,h,i)perylene (8270)	4.85 U	4.81 U	20.0 U	9.62 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Benzo(k)fluoranthene (8270)	4.85 U	4.81 U	20.0 U	9.62 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Benzoic Acid	24.3 U	24.0 U	1000 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U	
Benzyl alcohol	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U	
4-Bromophenyl-phenylether	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Butyl benzyl phthalate	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
4-Chloro-3-methylphenol	9.71 U	9.62 U	40.0 U	9.62 U	10.0 U	20.0 U	7.77 U	7.92 U	3.96 U	1.94 U	1.98 U	1.90 U	
4-Chloroaniline	14.6 U	14.4 U	60.0 U	14.4 U	15.0 U	30.0 U	11.7 U	11.9 U	5.94 U	2.91 U	2.97 U	2.86 U	
Bis(2-chloroethoxy)methane	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Bis(2-chloroethyl)ether	9.71 U	9.62 U	40.0 U	9.62 U	10.0 U	20.0 U	7.77 U	39.6 U	3.96 U	1.94 U	1.98 U	1.90 U	
Bis(2-chloroisopropyl)ether	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
2-Chloronaphthalene	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
2-Chlorophenol	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
4-Chlorophenylphenyl ether	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Chrysene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Di-n-butyl phthalate	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Di-n-octyl phthalate	9.71 U	9.62 U	40.0 U	19.2 U	10.0 U	20.0 U	7.77 U	7.92 U	3.96 U	1.94 U	1.98 U	1.90 U	
Dibenzo(a,h)anthracene (8270)	4.85 U	4.81 U	20.0 U	9.62 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
Dibenzofuran (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	4.19	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
1,2-Dichlorobenzene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
1,3-Dichlorobenzene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
1,4-Dichlorobenzene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
3,3-Dichlorobenzidine	48.5 U	48.1 U	200 U	48.1 U	50.0 U	100 U	38.8 U	39.6 U	19.8 U	9.71 U	9.90 U	9.52 U	
2,4-Dichlorophenol	14.6 U	14.4 U	60.0 U	14.4 U	15.0 U	30.0 U	11.7 U	11.9 U	5.94 U	2.91 U	2.97 U	2.86 U	
Diethyl phthalate	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	5.83 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
2,4-Dimethylphenol	14.6 U	14.4 U	60.0 U	14.4 U	15.0 U	30.0 U	11.7 U	11.9 U	5.94 U	2.91 U	2.97 U	2.86 U	
Dimethyl phthalate	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U	
4,6-Dinitro-2-methylphenol	72.8 U	72.1 U	300 U	72.1 U	75.0 U	150 U	58.3 U	59.4 U	29.7 U	14.6 U	14.9 U	14.3 U	
2,4-Dinitrophenol	121 U	120 U	500 U	120 U	125 U	250 U	97.1 U	99.0 U	49.5 U	24.3 U	24.8 U	23.8 U	
2,4-Dinitrotoluene	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U	

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	Dup of RW1											
	RW1 P5K0820-02 11/17/2005	W P5K0820-01 11/17/2005	LW019S P5K0698-06 11/16/2005	LW027S P5K0819-04 11/17/2005	N P5K0819-03 11/17/2005	P P5K0819-02 11/17/2005	Q P5K0819-01 11/17/2005	LW006D P5K0820-06 11/17/2005	LW009D P5K0820-05 11/17/2005	LW010D P5K0699-01 11/14/2005	LW011D P5K0820-04 11/17/2005	RW2 P5K0699-05 11/15/2005
2,6-Dinitrotoluene	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U
Bis(2-ethylhexyl)phthalate	48.5 U	48.1 U	200 U	48.1 U	50.0 U	100 U	38.8 U	39.6 U	19.8 U	13.6	9.90 U	9.52 U
Fluoranthene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
Fluorene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	5.48	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
Hexachlorobenzene	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
Hexachlorobutadiene (8270)	9.71 U	9.62 U	40.0 U	9.62 U	10.0 U	20.0 U	7.77 U	7.92 U	3.96 U	1.94 U	1.98 U	1.90 U
Hexachlorocyclopentadiene	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U
Hexachloroethane	9.71 U	9.62 U	40.0 U	9.62 U	10.0 U	20.0 U	7.77 U	7.92 U	3.96 U	1.94 U	1.98 U	1.90 U
Indeno(1,2,3-cd)pyrene (8270)	4.85 U	4.81 U	20.0 U	9.62 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
Isophorone	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
2-Methylnaphthalene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	37.2	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	2.02
2-Methylphenol	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
3- & 4-Methylphenol	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	48.9	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
Naphthalene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	17.6	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
2-Nitroaniline	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U
3-Nitroaniline	29.1 U	28.8 U	120 U	28.8 U	30.0 U	60.0 U	23.3 U	23.8 U	11.9 U	5.83 U	5.94 U	5.71 U
4-Nitroaniline	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U
Nitrobenzene	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
2-Nitrophenol	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U
4-Nitrophenol	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U
N-Nitroso-Di-N-Propylamine	9.71 U	9.62 U	40.0 U	9.62 U	10.0 U	20.0 U	7.77 U	7.92 U	3.96 U	1.94 U	1.98 U	1.90 U
N-Nitrosodiphenylamine	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
Pentachlorophenol (8270)	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U
Phenanthrene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
Phenol	9.71 U	9.62 U	40.0 U	9.62 U	17.3 J	80.5 J	7.77 U	7.92 U	3.96 U	1.94 U	1.98 U	1.90 U
Pyrene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
1,2,4-Trichlorobenzene (8270)	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
2,4,5-Trichlorophenol	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U
2,4,6-Trichlorophenol	24.3 U	24.0 U	100 U	24.0 U	25.0 U	50.0 U	19.4 U	19.8 U	9.90 U	4.85 U	4.95 U	4.76 U
Carbazole	4.85 U	4.81 U	20.0 U	4.81 U	5.00 U	10.0 U	3.88 U	3.96 U	1.98 U	0.971 U	0.990 U	0.952 U
PAHs (µg/L)												
EPA 8270SIM												
Acenaphthene (8270SIM)			0.905	0.594 U	0.902	5.55	3.88					
Acenaphthylene (8270SIM)			0.500 U	0.396 U	0.408 U	0.990 U	0.297 U					
Anthracene (8270SIM)			0.500 U	0.396 U	0.408 U	0.786	0.198 U					
Benzo(a)anthracene (8270SIM)			0.500 U	0.396 U	0.408 U	0.454	0.198 U					
Benzo(a)pyrene (8270SIM)			0.500 U	0.396 U	0.408 U	0.198 U	0.198 U					
Benzo(b)fluoranthene (8270SIM)			0.500 U	0.396 U	0.408 U	0.231	0.198 U					
Benzo(g,h,i)perylene (8270SIM)			0.500 U	0.396 U	0.408 U	0.198 U	0.198 U					
Benzo(k)fluoranthene (8270SIM)			0.500 U	0.396 U	0.408 U	0.198 U	0.198 U					
Chrysene (8270SIM)			0.500 U	0.396 U	0.408 U	0.447	0.198 U					
Dibenzo(a,h)anthracene (8270SIM)			1.00 U	0.792 U	0.816 U	0.396 U	0.396 U					

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FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	Dup of RW1											
	RW1 P5K0820-02 11/17/2005	W P5K0820-01 11/17/2005	LW019S P5K0698-06 11/16/2005	LW027S P5K0819-04 11/17/2005	N P5K0819-03 11/17/2005	P P5K0819-02 11/17/2005	Q P5K0819-01 11/17/2005	LW006D P5K0820-06 11/17/2005	LW009D P5K0820-05 11/17/2005	LW010D P5K0699-01 11/14/2005	LW011D P5K0820-04 11/17/2005	RW2 P5K0699-05 11/15/2005
Fluoranthene (8270SIM)			0.500 U	0.396 U	0.408 U	2.03	0.236					
Fluorene (8270SIM)			2.62	0.396 U	2.13	6.44	3.49					
Indeno(1,2,3-cd)pyrene (8270SIM)			0.500 U	0.396 U	0.408 U	0.198 U	0.198 U					
Naphthalene (8270SIM)			1.75 U	0.990 U	15.7	7.43 U	1.29 U					
Phenanthrene (8270SIM)			0.891	0.396 U	1.06	3.45	1.96					
Pyrene (8270SIM)			0.500 U	0.396 U	0.408 U	1.71	0.198 U					
VOLATILES (µg/L)												
EPA 8260B												
Acetone	25.0 U	25.0 U	25.0 U	25.0 U	250 U	500 U	125 U	47.5	25.0 U	25.0 U	25.0 U	25.0 U
Benzene	6.39	6.43	1.00 U	1.00 U	716	2470	220	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromobenzene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromodichloromethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromoform	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromomethane	5.00 U	5.00 U	5.00 U	5.00 U	50.0 U	100 U	25.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-Butanone	10.0 U	10.0 U	10.0 U	10.0 U	100 U	200 U	50.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
n-Butylbenzene	5.00 U	5.00 U	5.00 U	5.00 U	50.0 U	100 U	25.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
sec-Butylbenzene	4.37	4.35	5.25	1.00 U	201	20.0 U	5.8	1.06	1.00 U	1.00 U	1.00 U	5.92
tert-Butylbenzene	1.5	1.59	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	3.15	1.00 U	1.00 U	1.00 U	1.85
Carbon disulfide	10.0 U	10.0 U	10.0 U	10.0 U	100 U	200 U	50.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Carbon tetrachloride	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chlorobenzene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chloroethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chloroform	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chloromethane	5.00 U	5.00 U	5.00 U	5.00 U	50.0 U	100 U	25.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-Chlorotoluene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
4-Chlorotoluene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dibromo-3-chloropropane	5.00 U	5.00 U	5.00 U	5.00 U	50.0 U	100 U	25.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Dibromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dibromoethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Dibromomethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dichlorobenzene (8260)	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,3-Dichlorobenzene (8260)	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,4-Dichlorobenzene (8260)	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Dichlorodifluoromethane	5.00 U	5.00 U	5.00 U	5.00 U	50.0 U	100 U	25.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,1-Dichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-Dichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
cis-1,2-Dichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
trans-1,2-Dichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,3-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U

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	RW1 P5K0820-02 11/17/2005	W P5K0820-01 11/17/2005	LW019S P5K0698-06 11/16/2005	LW027S P5K0819-04 11/17/2005	N P5K0819-03 11/17/2005	P P5K0819-02 11/17/2005	Q P5K0819-01 11/17/2005	LW006D P5K0820-06 11/17/2005	LW009D P5K0820-05 11/17/2005	LW010D P5K0699-01 11/14/2005	LW011D P5K0820-04 11/17/2005	RW2 P5K0699-05 11/15/2005
2,2-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
cis-1,3-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
trans-1,3-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Ethylbenzene	40.1	41	1.00 U	1.00 U	131	72.8	6.5	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Hexachlorobutadiene (8260)	4.00 U	4.00 U	4.00 U	4.00 U	40.0 U	80.0 U	20.0 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
2-Hexanone	10.0 U	10.0 U	10.0 U	10.0 U	100 U	200 U	50.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Isopropylbenzene	27.5	27.7	7.05	2.00 U	51.6	40.0 U	52.5	2.00 U	2.00 U	2.00 U	2.00 U	37.3
4-Isopropyltoluene	2.13	2.13	2.00 U	2.00 U	20.0 U	40.0 U	10.0 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
4-Methyl-2-Pentanone (MIBK)	5.00 U	5.00 U	5.00 U	5.00 U	50.0 U	100 U	25.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Methyl tert-butyl ether	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Methylene chloride	5.00 U	5.00 U	5.00 U	5.00 U	50.0 U	100 U	25.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Naphthalene (8260)	10.4	10.2	2.00 U	2.00 U	38.9	40.0 U	10.0 U	2.00 U	2.00 U	2.00 U	2.00 U	2.48
n-Propylbenzene	26.4	26.7	10.3	1.00 U	77.5	20.0 U	96.6	1.00 U	1.00 U	1.00 U	1.00 U	34.3
Styrene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,1,2-Tetrachloroethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2,2-Tetrachloroethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Tetrachloroethene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Toluene	1.00 U	1.00 U	1.00 U	1.00 U	19	64.2	12.6	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,3-Trichlorobenzene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,4-Trichlorobenzene (8260)	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,1-Trichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-Trichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Trichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Trichlorofluoromethane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,3-Trichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,4-Trimethylbenzene	87.1	90.2	1.00 U	1.00 U	244	96.2	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,3,5-Trimethylbenzene	7.16	7.62	1.00 U	1.00 U	70.4	67.4	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Vinyl chloride	1.00 U	1.00 U	1.00 U	1.00 U	10.0 U	20.0 U	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
o-Xylene	18.6	19.1	1.00 U	1.00 U	62.2	221	5.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
m,p-Xylene	39.5	41.5	2.00 U	2.00 U	314	412	12.1	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U

NWTPH-G (µg/L)

Gasoline Range Hydrocarbons	826 J	880 J	315	240	5100 J	8560	1530 J	329	80.0 U	80.0 UJ	80.0 U	371
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NWTPH-Dx (µg/L)

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	RW1	Dup of RW1 W	LW019S	LW027S	N	P	Q	LW006D	LW009D	LW010D	LW011D	RW2
	P5K0820-02 11/17/2005	P5K0820-01 11/17/2005	P5K0698-06 11/16/2005	P5K0819-04 11/17/2005	P5K0819-03 11/17/2005	P5K0819-02 11/17/2005	P5K0819-01 11/17/2005	P5K0820-06 11/17/2005	P5K0820-05 11/17/2005	P5K0699-01 11/14/2005	P5K0820-04 11/17/2005	P5K0699-05 11/15/2005
Diesel Range Hydrocarbons	483	516	1020	2090	3410	2720	1480	452 J	248 U	245 U	250 U	245 U
Heavy Oil Range Hydrocarbons	481 U	481 U	495 U	500 U	500 U	500 U	500 U	495 U	495 U	490 U	500 U	490 U
TOTAL METALS (µg/L)												
EPA 6020/7470A												
Antimony	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Arsenic	3.66	3.76	46	59.6	38.3	35.9	41.1	10.8	32.6	15.3	6.96	22
Beryllium	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Cadmium	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chromium	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.04	5.7	27.8	1.00 U
Copper	2.62	2.51	2.00 U	2.00 U	2.00 U	2.81	2.00 U	2.00 U	2.00 U	9.24	37.3	2.00 U
Lead	1.00 U	1.00 U	1.00 U	1.00 U	6.83	26	12.4	1.00 U	1.00 U	2.15	15.1	1.00 U
Mercury	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
Nickel	87.6	88.2	2.00 U	5.35	2.26	3.98	2.11	15.5	2.00 U	5.26	70.6	23.5
Selenium	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Silver	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Thallium	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Zinc	5.00 U	5.00 U	6.17	5.00 U	5.00 U	5.00 U	5.00 U	8.29	5.00 U	16.6	85.1	8.11
DISSOLVED METALS (µg/L)												
EPA 6020												
Antimony (Dissolved)												
Arsenic (Dissolved)												
Beryllium (Dissolved)												
Cadmium (Dissolved)												
Chromium (Dissolved)												
Copper (Dissolved)												
Lead (Dissolved)												
Nickel (Dissolved)												
Selenium (Dissolved)												
Silver (Dissolved)												
Thallium (Dissolved)												
Zinc (Dissolved)												
DIOXINS AND FURANS (ng/L)												
EPA 1613B												
2,3,7,8-TCDF	0.00988 U											
Total TCDF	0.00988 U											
2,3,7,8-TCDD	0.00988 U											
Total TCDD	0.00988 U											
1,2,3,7,8-PeCDF	0.0494 U											
2,3,4,7,8-PeCDF	0.0494 U											
Total PeCDF	0.0494 U											

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	Dup of RW1											
	RW1 P5K0820-02 11/17/2005	W P5K0820-01 11/17/2005	LW019S P5K0698-06 11/16/2005	LW027S P5K0819-04 11/17/2005	N P5K0819-03 11/17/2005	P P5K0819-02 11/17/2005	Q P5K0819-01 11/17/2005	LW006D P5K0820-06 11/17/2005	LW009D P5K0820-05 11/17/2005	LW010D P5K0699-01 11/14/2005	LW011D P5K0820-04 11/17/2005	RW2 P5K0699-05 11/15/2005
1,2,3,7,8-PeCDD	0.0494 U											
Total PeCDD	0.0494 U											
1,2,3,4,7,8-HxCDF	0.0494 U											
1,2,3,6,7,8-HxCDF	0.0494 U											
2,3,4,6,7,8-HxCDF	0.0494 U											
1,2,3,7,8,9-HxCDF	0.0494 U											
Total HxCDF	0.0494 U											
1,2,3,4,7,8-HxCDD	0.0494 U											
1,2,3,6,7,8-HxCDD	0.0494 U											
1,2,3,7,8,9-HxCDD	0.0494 U											
Total HxCDD	0.0494 U											
1,2,3,4,6,7,8-HpCDF	0.0494 U											
1,2,3,4,7,8,9-HpCDF	0.0494 U											
Total HpCDF	0.0494 U											
1,2,3,4,6,7,8-HpCDD	0.0494 U											
Total HpCDD	0.0494 U											
OCDF	0.0988 U											
OCDD	0.254											
Total TEQ	0.000254											
FIELD PARAMETERS												
pH	6.61	6.59	7.40	7.10	6.57	6.64	7.47	6.66	7.49	6.27	6.76	7.55
Temperature (deg C)	15.9	15.9	13.9	14.9	14.0	12.8	14.7	14.6	15.7	14.0	14.9	13.6
Conductivity (uS/cm)	234	233	654	358	198	253	632	196	312	128	299	385
Dissolved oxygen (mg/l)	1.88	1.07	3.23	3.10		0.71	2.43	1.19	3.64	7.77	1.55	3.79
Turbidity (NTU)	8	10	0	0	0	6	0	0	14	102	373	0
Ferrous Iron (mg/L)	10	10										

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	LW022D	LW023D	LW024D	LW025D	LW035D	LW036D	LW037D	LW038D	Dup of LW038D		LW039D	LW040D	LW045D
	P5K0698-12 11/16/2005	P5K0698-13 11/16/2005	P5K0698-09 11/16/2005	P5K0698-10 11/16/2005	P5K0698-11 11/16/2005	P5K0698-05 11/15/2005	P5K0698-02 11/15/2005	P5K0698-03 11/15/2005	Y P5K0698-01 11/15/2005		P5K0698-04 11/15/2005	P5K0698-07 11/16/2005	P5K0698-08 11/16/2005
PENTACHLOROPHENOL (µg/L)													
EPA 8270SIM													
Pentachlorophenol (8270SIM)													
SEMIVOLATILES (µg/L)													
EPA 8270C													
2,3,4,6-Tetrachlorophenol	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U		5.00 U	4.90 U	5.10 U
Acenaphthene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
Acenaphthylene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
Anthracene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
Benzo(a)anthracene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
Benzo(a)pyrene (8270)	9.80 U	9.90 U	19.8 U	10.0 U	10.0 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	10.2 U
Benzo(b)fluoranthene (8270)	9.80 U	9.90 U	19.8 U	10.0 U	10.0 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	10.2 U
Benzo(g,h,i)perylene (8270)	9.80 U	9.90 U	19.8 U	10.0 U	10.0 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	10.2 U
Benzo(k)fluoranthene (8270)	9.80 U	9.90 U	19.8 U	10.0 U	10.0 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	10.2 U
Benzoic Acid	49.0 U	49.5 U	990 U	50.0 U	50.0 U	49.5 U	48.5 U	49.5 U	49.5 U		50.0 U	49.0 U	51.0 U
Benzyl alcohol	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U		5.00 U	4.90 U	5.10 U
4-Bromophenyl-phenylether	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
Butyl benzyl phthalate	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
4-Chloro-3-methylphenol	1.96 U	1.98 U	39.6 U	2.00 U	2.00 U	1.98 U	1.94 U	1.98 U	1.98 U		2.00 U	1.96 U	2.04 U
4-Chloroaniline	2.94 U	2.97 U	59.4 U	3.00 U	3.00 U	2.97 U	2.91 U	2.97 U	2.97 U		3.00 U	2.94 U	3.06 U
Bis(2-chloroethoxy)methane	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
Bis(2-chloroethyl)ether	1.96 U	1.98 U	39.6 U	2.00 U	2.00 U	1.98 U	1.94 U	1.98 U	1.98 U		2.00 U	1.96 U	2.04 U
Bis(2-chloroisopropyl)ether	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
2-Chloronaphthalene	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
2-Chlorophenol	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
4-Chlorophenylphenyl ether	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
Chrysene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
Di-n-butyl phthalate	0.980 U	0.990 U	19.8 U	1.24	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
Di-n-octyl phthalate	19.6 U	19.8 U	39.6 U	20.0 U	20.0 U	1.98 U	1.94 U	1.98 U	1.98 U		2.00 U	1.96 U	20.4 U
Dibenzo(a,h)anthracene (8270)	9.80 U	9.90 U	19.8 U	10.0 U	10.0 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	10.2 U
Dibenzofuran (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
1,2-Dichlorobenzene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
1,3-Dichlorobenzene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
1,4-Dichlorobenzene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
3,3-Dichlorobenzidine	9.80 U	9.90 U	19.8 U	10.0 U	10.0 U	9.90 U	9.71 U	9.90 U	9.90 U		10.0 U	9.80 U	10.2 U
2,4-Dichlorophenol	2.94 U	2.97 U	59.4 U	3.00 U	3.00 U	2.97 U	2.91 U	2.97 U	2.97 U		3.00 U	2.94 U	3.06 U
Diethyl phthalate	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
2,4-Dimethylphenol	2.94 U	2.97 U	59.4 U	3.00 U	3.00 U	2.97 U	2.91 U	2.97 U	2.97 U		3.00 U	2.94 U	3.06 U
Dimethyl phthalate	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U		1.00 U	0.980 U	1.02 U
4,6-Dinitro-2-methylphenol	14.7 U	14.9 U	297 U	15.0 U	15.0 U	14.9 U	14.6 U	14.9 U	14.9 U		15.0 U	14.7 U	15.3 U
2,4-Dinitrophenol	24.5 U	24.8 U	495 U	25.0 U	25.0 U	24.8 U	24.3 U	24.8 U	24.8 U		25.0 U	24.5 U	25.5 U
2,4-Dinitrotoluene	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U		5.00 U	4.90 U	5.10 U

TABLE 1
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FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	LW022D	LW023D	LW024D	LW025D	LW035D	LW036D	LW037D	LW038D	Dup of LW038D Y	LW039D	LW040D	LW045D
	P5K0698-12 11/16/2005	P5K0698-13 11/16/2005	P5K0698-09 11/16/2005	P5K0698-10 11/16/2005	P5K0698-11 11/16/2005	P5K0698-05 11/15/2005	P5K0698-02 11/15/2005	P5K0698-03 11/15/2005	P5K0698-01 11/15/2005	P5K0698-04 11/15/2005	P5K0698-07 11/16/2005	P5K0698-08 11/16/2005
2,6-Dinitrotoluene	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U	5.00 U	4.90 U	5.10 U
Bis(2-ethylhexyl)phthalate	9.80 U	9.90 U	198 U	10.0 U	10.0 U	9.90 U	9.71 U	9.90 U	9.90 U	10.0 U	9.80 U	10.2 U
Fluoranthene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
Fluorene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
Hexachlorobenzene	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
Hexachlorobutadiene (8270)	1.96 U	1.98 U	39.6 U	2.00 U	2.00 U	1.98 U	1.94 U	1.98 U	1.98 U	2.00 U	1.96 U	2.04 U
Hexachlorocyclopentadiene	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U	5.00 U	4.90 U	5.10 U
Hexachloroethane	1.96 U	1.98 U	39.6 U	2.00 U	2.00 U	1.98 U	1.94 U	1.98 U	1.98 U	2.00 U	1.96 U	2.04 U
Indeno(1,2,3-cd)pyrene (8270)	9.80 U	9.90 U	19.8 U	10.0 U	10.0 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	10.2 U
Isophorone	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
2-Methylnaphthalene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
2-Methylphenol	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
3- & 4-Methylphenol	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
Naphthalene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
2-Nitroaniline	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U	5.00 U	4.90 U	5.10 U
3-Nitroaniline	5.88 U	5.94 U	119 U	6.00 U	6.00 U	5.94 U	5.83 U	5.94 U	5.94 U	6.00 U	5.88 U	6.12 U
4-Nitroaniline	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U	5.00 U	4.90 U	5.10 U
Nitrobenzene	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
2-Nitrophenol	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U	5.00 U	4.90 U	5.10 U
4-Nitrophenol	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U	5.00 U	4.90 U	5.10 U
N-Nitroso-Di-N-Propylamine	1.96 U	1.98 U	39.6 U	2.00 U	2.00 U	1.98 U	1.94 U	1.98 U	1.98 U	2.00 U	1.96 U	2.04 U
N-Nitrosodiphenylamine	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
Pentachlorophenol (8270)	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U	5.00 U	4.90 U	5.10 U
Phenanthrene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
Phenol	1.96 U	1.98 U	39.6 U	2.00 U	2.00 U	1.98 U	1.94 U	1.98 U	1.98 U	2.00 U	1.96 U	2.04 U
Pyrene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
1,2,4-Trichlorobenzene (8270)	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
2,4,5-Trichlorophenol	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U	5.00 U	4.90 U	5.10 U
2,4,6-Trichlorophenol	4.90 U	4.95 U	99.0 U	5.00 U	5.00 U	4.95 U	4.85 U	4.95 U	4.95 U	5.00 U	4.90 U	5.10 U
Carbazole	0.980 U	0.990 U	19.8 U	1.00 U	1.00 U	0.990 U	0.971 U	0.990 U	0.990 U	1.00 U	0.980 U	1.02 U
PAHs (µg/L)												
EPA 8270SIM												
Acenaphthene (8270SIM)	0.0971 U	0.458	1.18	0.366	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Acenaphthylene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.0990 U	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Anthracene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.133	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	1.66
Benzo(a)anthracene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.0990 U	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Benzo(a)pyrene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.0990 U	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Benzo(b)fluoranthene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.0990 U	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Benzo(g,h,i)perylene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.0990 U	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Benzo(k)fluoranthene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.0990 U	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Chrysene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.0990 U	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Dibenzo(a,h)anthracene (8270SIM)	0.194 U	0.200 U	1.00 U	0.198 U	0.204 U	0.198 U	0.192 U	0.196 U	0.194 U	0.200 U	0.194 U	0.202 U

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	LW022D	LW023D	LW024D	LW025D	LW035D	LW036D	LW037D	LW038D	Dup of LW038D Y	LW039D	LW040D	LW045D
	P5K0698-12 11/16/2005	P5K0698-13 11/16/2005	P5K0698-09 11/16/2005	P5K0698-10 11/16/2005	P5K0698-11 11/16/2005	P5K0698-05 11/15/2005	P5K0698-02 11/15/2005	P5K0698-03 11/15/2005	P5K0698-01 11/15/2005	P5K0698-04 11/15/2005	P5K0698-07 11/16/2005	P5K0698-08 11/16/2005
Fluoranthene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.256	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Fluorene (8270SIM)	0.0971 U	0.198	2.69	0.611	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Indeno(1,2,3-cd)pyrene (8270SIM)	0.0971 U	0.100 U	0.500 U	0.0990 U	0.102 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.101 U
Naphthalene (8270SIM)	0.146 U	1.00 U	2.00 U	0.792 U	0.306 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.505 U
Phenanthrene (8270SIM)	0.0971 U	0.100 U	1.38	0.435	0.153 U	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.198
Pyrene (8270SIM)	0.099	0.100 U	0.500 U	0.393	0.126	0.0990 U	0.0962 U	0.0980 U	0.0971 U	0.100 U	0.0971 U	0.122
VOLATILES (µg/L)												
EPA 8260B												
Acetone	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Benzene	1.00 U	8.03	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromobenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromodichloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromoform	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Bromomethane	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-Butanone	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
n-Butylbenzene	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
sec-Butylbenzene	1.00 U	1.81	4.72	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.63
tert-Butylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Carbon disulfide	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Carbon tetrachloride	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chlorobenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chloroform	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Chloromethane	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
2-Chlorotoluene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
4-Chlorotoluene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dibromo-3-chloropropane	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Dibromochloromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dibromoethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Dibromomethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dichlorobenzene (8260)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,3-Dichlorobenzene (8260)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,4-Dichlorobenzene (8260)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Dichlorodifluoromethane	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
1,1-Dichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-Dichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
cis-1,2-Dichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
trans-1,2-Dichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,3-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U

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FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	LW022D	LW023D	LW024D	LW025D	LW035D	LW036D	LW037D	LW038D	Dup of LW038D Y	LW039D	LW040D	LW045D
	P5K0698-12 11/16/2005	P5K0698-13 11/16/2005	P5K0698-09 11/16/2005	P5K0698-10 11/16/2005	P5K0698-11 11/16/2005	P5K0698-05 11/15/2005	P5K0698-02 11/15/2005	P5K0698-03 11/15/2005	P5K0698-01 11/15/2005	P5K0698-04 11/15/2005	P5K0698-07 11/16/2005	P5K0698-08 11/16/2005
2,2-Dichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
cis-1,3-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
trans-1,3-Dichloropropene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Ethylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Hexachlorobutadiene (8260)	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
2-Hexanone	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Isopropylbenzene	2.00 U	8.61	10.1	2.55	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	10.8
4-Isopropyltoluene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
4-Methyl-2-Pentanone (MIBK)	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Methyl tert-butyl ether	1.00 U	16.4	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Methylene chloride	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Naphthalene (8260)	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
n-Propylbenzene	1.00 U	1.93	10.1	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.05
Styrene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,1,2-Tetrachloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2,2-Tetrachloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Tetrachloroethene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Toluene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,3-Trichlorobenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,4-Trichlorobenzene (8260)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,1-Trichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,1,2-Trichloroethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Trichloroethene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Trichlorofluoromethane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,3-Trichloropropane	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,2,4-Trimethylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
1,3,5-Trimethylbenzene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Vinyl chloride	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
o-Xylene	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
m,p-Xylene	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
NWTPH-G (µg/L)												
Gasoline Range Hydrocarbons	80.0 U	292	387	97.9	80.0 U	80.0 U	80.0 U	80.0 U	80.0 U	80.0 U	80.0 U	80.0 U
NWTPH-Dx (µg/L)												

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TIME OIL NORTHWEST TERMINAL

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	P5K0698-12 11/16/2005	P5K0698-13 11/16/2005	P5K0698-09 11/16/2005	P5K0698-10 11/16/2005	P5K0698-11 11/16/2005	P5K0698-05 11/15/2005	P5K0698-02 11/15/2005	P5K0698-03 11/15/2005	P5K0698-01 11/15/2005	Y	P5K0698-04 11/15/2005	P5K0698-07 11/16/2005	P5K0698-08 11/16/2005
Diesel Range Hydrocarbons	243 U	243 U	591	248 U	278 U	250 U	245 U	248 U	245 U		243 U	243 U	250 U
Heavy Oil Range Hydrocarbons	485 U	485 U	495 U	495 U	556 U	500 U	490 U	495 U	490 U		485 U	485 U	500 U
TOTAL METALS (µg/L)													
EPA 6020/7470A													
Antimony	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U		1.00 U	1.00 U	1.00 U
Arsenic	22.2	55.4	49.7	44.9	10.5	1.00 U	1.00 U	1.64	1.57		7.76	4.37	48.1
Beryllium	1.00 U	1.00 U	1.00 U	1.15	1.58	1.00 U	1.00 U	1.00 U	1.00 U		1.00 U	1.00 U	2.1
Cadmium	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U		1.00 U	1.00 U	1.00 U
Chromium	2.08	14.9	9.61	26.7	31.8	1.00 U	1.00 U	1.00 U	1.00 U		1.00 U	19.8	38.6
Copper	3.22	26.1	14.6	38.8	44.4	2.00 U	2.00 U	2.00 U	2.00 U		2.00 U	26.6	47.6
Lead	1.37	9.1	6.4	18.9	17.2	1.00 U	1.00 U	1.00 U	1.00 U		1.00 U	7.76	18.2
Mercury	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U		0.200 U	0.200 U	0.200 U
Nickel	4.9	13.8	10.8	32.4	56.8	2.00 U	2.00 U	2.00 U	2.00 U		6.12	27.6	53.2
Selenium	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U		2.00 U	2.00 U	2.00 U
Silver	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U		1.00 U	1.00 U	1.00 U
Thallium	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U		1.00 U	1.00 U	1.00 U
Zinc	18	51.5	36.8	104	166	5.00 U	5.00 U	5.00 U	5.12		5.00 U	73	159
DISSOLVED METALS (µg/L)													
EPA 6020													
Antimony (Dissolved)						1.00 U	1.00 U	1.00 U	1.00 U		1.00 U		
Arsenic (Dissolved)						1.00 U	1.00 U	1.45	1.51		7.99		
Beryllium (Dissolved)						1.00 U	1.00 U	1.00 U	1.00 U		1.00 U		
Cadmium (Dissolved)						1.00 U	1.00 U	1.00 U	1.00 U		1.00 U		
Chromium (Dissolved)						1.00 U	1.00 U	1.00 U	1.00 U		1.00 U		
Copper (Dissolved)						2.00 U	2.00 U	2.36	2.00 U		2.00 U		
Lead (Dissolved)						1.00 U	1.00 U	1.00 U	1.00 U		1.00 U		
Nickel (Dissolved)						2.00 U	2.00 U	2.00 U	2.00 U		8.85		
Selenium (Dissolved)						2.00 U	2.00 U	2.00 U	2.00 U		2.00 U		
Silver (Dissolved)						1.00 U	1.00 U	1.00 U	1.00 U		1.00 U		
Thallium (Dissolved)						1.00 U	1.00 U	1.00 U	1.00 U		1.00 U		
Zinc (Dissolved)						5.00 U	5.00 U	5.00 U	5.00 U		5.00 U		
DIOXINS AND FURANS (ng/L)													
EPA 1613B													
2,3,7,8-TCDF													
Total TCDF													
2,3,7,8-TCDD													
Total TCDD													
1,2,3,7,8-PeCDF													
2,3,4,7,8-PeCDF													
Total PeCDF													

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
FOURTH QUARTER SAMPLING EVENT, NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Parameter	LW022D	LW023D	LW024D	LW025D	LW035D	LW036D	LW037D	LW038D	Dup of LW038D Y	LW039D	LW040D	LW045D
	P5K0698-12 11/16/2005	P5K0698-13 11/16/2005	P5K0698-09 11/16/2005	P5K0698-10 11/16/2005	P5K0698-11 11/16/2005	P5K0698-05 11/15/2005	P5K0698-02 11/15/2005	P5K0698-03 11/15/2005	P5K0698-01 11/15/2005	P5K0698-04 11/15/2005	P5K0698-07 11/16/2005	P5K0698-08 11/16/2005
1,2,3,7,8-PeCDD												
Total PeCDD												
1,2,3,4,7,8-HxCDF												
1,2,3,6,7,8-HxCDF												
2,3,4,6,7,8-HxCDF												
1,2,3,7,8,9-HxCDF												
Total HxCDF												
1,2,3,4,7,8-HxCDD												
1,2,3,6,7,8-HxCDD												
1,2,3,7,8,9-HxCDD												
Total HxCDD												
1,2,3,4,6,7,8-HpCDF												
1,2,3,4,7,8,9-HpCDF												
Total HpCDF												
1,2,3,4,6,7,8-HpCDD												
Total HpCDD												
OCDF												
OCDD												
Total TEQ												
FIELD PARAMETERS												
pH	7.20	7.75	6.32	5.77	7.44	6.72	6.61	7.27	7.28	7.32	6.03	7.34
Temperature (deg C)	14.8	14.1	14.5	14.9	13.7	15.1	14.2	15.5	15.5	14.9	13.0	13.4
Conductivity (uS/cm)	276	574	225	177	662	120	55	74	74	76	147	630
Dissolved oxygen (mg/l)	3.25	2.66	1.72		4.35	1.55	3.42	2.62	2.60	2.90		2.86
Turbidity (NTU)	163	248	149	772	755	0	11	0	0	0	546	999
Ferrous Iron (mg/L)												

TABLE 2
LNAPL MEASUREMENTS AND OBSERVATIONS IN GROUNDWATER
QUARTERLY SAMPLING EVENTS, MARCH 1997 - NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Well	Date	Time	LNAPL Thickness (ft)	NOTES
N	05/31/1994	16:30	----	
N	06/01/1994	08:35	----	
N	06/17/1994	15:35	----	
N	07/19/1994	09:56	----	Strong odor noted; no product
N	08/17/1994	08:06	----	
N	09/16/1994	07:58	----	Hydrocarbon odor
N	10/17/1994	09:25	----	
N	11/21/1994	12:26	----	Hydrocarbon odor
N	12/19/1994	11:42	----	Hydrocarbon odor
N	01/18/1995	11:48	----	
N	02/21/1995	13:54	----	
N	03/21/1995	13:21	----	
N	04/19/1995	13:15	----	Hydrocarbon odor
N	05/19/1995	14:04	----	
N	07/17/1995	14:15	----	
N	08/22/1995	08:16	----	
N	09/22/1995	09:05	----	
N	11/20/1995	08:26	----	
N	12/01/1995	09:01	----	
N	12/19/1995	07:53	----	
N	01/19/1996	09:06	----	
N	02/20/1996	11:14	----	
N	03/19/1996	09:41	----	
N	04/19/1996	12:12	0.12	Free product
N	07/22/1996	14:50	0.04	1/2" oil
N	08/20/1996	14:54	0.06	3/4" oil
N	09/24/1996	09:39	----	Odor, sheen, no product
N	10/28/1996	12:03	----	Strong hydrocarbon odor
N	12/13/1996	11:55	----	Thin product layer <0.01"; odor noted on opening wells
N	03/25/1997	11:48	----	
N	03/31/1997	08:59	----	Hydrocarbon odor, product
N	07/16/1997	07:20	1.20	Light brown color; thick coating on probe
N	10/21/1997	16:09	----	No product - strong petroleum odor
N	10/23/1997	17:20	----	No product - strong petroleum odor
N	01/27/1998	11:13	0.02	
N	05/18/1998	17:20	0.06	
N	08/17/1998	10:40	0.02	Thin coat of thick product
N	11/13/1998	09:48	0.01	
N	02/16/1999	12:55	0.27	Strong petroleum odor
N	05/18/1999	14:47	0.04	
N	09/21/1999	11:23	0.01	
N	12/06/1999	14:00	----	
N	02/16/2000	10:10	----	
N	05/23/2000	16:24	----	Strong petroleum odor, no product
N	08/29/2000	13:07	----	
N	11/09/2000	12:26	0.03	
N	02/12/2001	15:49	----	
N	06/04/2001	11:31	----	
N	08/16/2001	10:29	----	Trace product
N	11/28/2001	11:27	----	Trace product
N	02/27/2002	13:25	----	
N	04/05/2002	08:09	----	
N	05/29/2002	00:00	----	
N	06/27/2002	14:12	----	
N	08/26/2002	15:56	----	
N	11/13/2002	07:27	0.03	Product present
N	02/11/2003	08:49	----	
N	05/08/2003	06:51	----	
N	08/27/2003	13:33	----	
N	10/23/2003	12:08	----	
N	02/19/2004	12:21	----	
N	06/09/2004	07:36	----	
N	08/10/2004	10:55	----	
N	11/18/2004	08:38	----	
N	02/15/2005	10:38	----	Slight product odor
N	06/07/2005	19:15	----	
N	08/16/2005	16:27	----	
N	11/14/2005	10:05	----	
P	05/31/1994	16:34	----	
P	06/01/1994	08:39	----	Strong odor; heavy sheen; no measurable free phase product
P	06/17/1994	15:41	----	
P	07/19/1994	10:08	----	Strong odor noted; no product
P	08/17/1994	08:09	----	
P	09/16/1994	08:00	----	Hydrocarbon odor

TABLE 2
LNAPL MEASUREMENTS AND OBSERVATIONS IN GROUNDWATER
QUARTERLY SAMPLING EVENTS, MARCH 1997 - NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Well	Date	Time	LNAPL Thickness (ft)	NOTES
P	10/17/1994	09:27	---	
P	11/21/1994	12:29	---	Hydrocarbon odor
P	12/19/1994	11:44	---	Hydrocarbon odor
P	01/18/1995	11:49	---	
P	02/21/1995	13:58	---	
P	03/21/1995	13:22	---	
P	04/19/1995	13:17	---	
P	05/19/1995	14:06	---	
P	07/17/1995	14:16	---	
P	08/22/1995	08:17	---	
P	09/22/1995	09:07	---	
P	11/20/1995	08:28	---	
P	12/01/1995	09:02	---	
P	12/19/1995	07:56	---	
P	01/19/1996	09:07	---	Hydrocarbon odor
P	02/20/1996	11:16	---	Hydrocarbon odor
P	03/19/1996	09:43	---	Well has spots of oil on gauge
P	04/19/1996	12:21	0.08	Free product
P	07/22/1996	14:54	0.20	2-3/8" oil
P	08/20/1996	15:01	0.08	1" oil
P	09/24/1996	09:46	0.23	2-3/4" oil, product 1.5" on tape and bob
P	10/28/1996	12:07	---	Strong hydrocarbon odor
P	12/13/1996	11:58	---	Thin product layer <0.01"; odor noted on opening wells
P	03/25/1997	11:45	---	
P	03/31/1997	08:55	---	Hydrocarbon odor, product
P	07/16/1997	07:15	0.17	Light coating on probe; light brown color
P	10/21/1997	16:05	---	No product - strong petroleum odor
P	10/23/1997	17:25	---	No product - strong petroleum odor
P	01/27/1998	11:09	---	
P	05/18/1998	17:18	---	Trace of product on probe
P	08/17/1998	10:37	0.01	Sheen on probe, strong petroleum odor
P	11/13/1998	09:46	0.05	Strong gasoline odor
P	02/16/1999	12:52	0.06	Strong petroleum odor
P	05/18/1999	14:43	0.13	
P	09/21/1999	11:20	0.01	
P	12/06/1999	13:55	---	
P	02/16/2000	10:08	---	
P	05/23/2000	16:21	---	Trace of product on surface
P	08/29/2000	13:04	0.01	
P	11/09/2000	12:24	0.03	
P	02/12/2001	15:46	---	
P	06/04/2001	11:27	---	Trace product
P	08/16/2001	10:28	---	
P	11/28/2001	11:24	---	
P	02/27/2002	13:22	0.10	Strong ethanol-like odor
P	04/05/2002	08:07	0.10	
P	05/29/2002	00:00	---	Trace product
P	06/27/2002	14:11	---	
P	08/26/2002	15:54	---	
P	11/13/2002	07:25	0.04	Product present
P	02/11/2003	08:44	0.01	Product present
P	05/08/2003	06:47	0.01	Product barely present
P	08/27/2003	13:30	---	
P	10/23/2003	12:05	0.02	Trace product
P	02/19/2004	12:19	---	
P	06/09/2004	07:35	---	New reference elevation July 2004
P	08/10/2004	10:53	---	
P	11/18/2004	08:37	---	
P	02/15/2005	10:43	---	Slight product odor
P	06/07/2005	19:20	---	
P	08/16/2005	16:23	---	Strong petro odor
P	11/14/2005	10:08	---	
Q	05/31/1994	16:35	---	
Q	06/01/1994	08:50	0.01	Free product
Q	06/17/1994	15:49	---	No product
Q	07/19/1994	10:14	---	Strong odor noted; no product
Q	08/17/1994	08:11	---	
Q	09/16/1994	08:02	---	Hydrocarbon odor
Q	10/17/1994	09:29	---	
Q	11/21/1994	12:33	---	Hydrocarbon odor
Q	12/19/1994	11:45	---	Hydrocarbon odor
Q	01/18/1995	11:51	---	
Q	02/21/1995	14:02	---	
Q	03/21/1995	13:23	---	

TABLE 2
LNAPL MEASUREMENTS AND OBSERVATIONS IN GROUNDWATER
QUARTERLY SAMPLING EVENTS, MARCH 1997 - NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Well	Date	Time	LNAPL Thickness (ft)	NOTES
Q	04/19/1995	13:18	---	
Q	05/19/1995	14:07	---	
Q	07/17/1995	14:17	---	
Q	08/22/1995	08:18	---	
Q	09/22/1995	09:11	---	
Q	11/20/1995	08:30	---	
Q	12/01/1995	09:03	---	
Q	12/19/1995	07:58	---	
Q	01/19/1996	09:08	---	
Q	02/20/1996	11:18	---	
Q	03/19/1996	09:45	0.51	Free product
Q	04/19/1996	12:24	0.52	Free product
Q	07/22/1996	15:00	0.01	1/8" oil
Q	08/20/1996	15:06	0.04	1/2" oil
Q	09/24/1996	09:59	---	Odor, sheen, no product
Q	10/28/1996	12:09	---	Strong hydrocarbon odor
Q	12/13/1996	12:01	---	Thin product layer <0.01"; odor noted on opening wells
Q	03/25/1997	11:42	---	
Q	03/31/1997	08:52	---	Hydrocarbon odor
Q	07/16/1997	07:10	0.02	Light coating on probe; light brown color
Q	10/21/1997	16:04	---	No product - strong petroleum odor
Q	10/23/1997	17:29	---	No product - strong petroleum odor
Q	01/27/1998	11:05	---	
Q	05/18/1998	17:16	---	
Q	08/17/1998	10:35	---	Slight sheen on probe; no product, strong petroleum odor
Q	11/13/1998	09:44	0.01	Strong gasoline odor
Q	02/16/1999	12:49	0.01	Strong petroleum odor
Q	05/18/1999	14:40	---	Strong odor when cap removed
Q	09/21/1999	11:17	---	
Q	12/06/1999	13:53	---	
Q	02/16/2000	10:06	---	Film of product
Q	05/23/2000	16:19	---	Strong petroleum odor, no product
Q	08/29/2000	13:01	---	
Q	11/09/2000	12:23	---	Trace of product
Q	02/12/2001	15:45	---	
Q	06/04/2001	11:25	---	
Q	08/16/2001	10:26	---	Trace product
Q	11/28/2001	11:21	0.42	
Q	02/27/2002	13:20	---	Strong petroleum odor, no product
Q	04/05/2002	08:05	---	Trace product
Q	05/29/2002	00:00	---	Trace product
Q	06/27/2002	14:10	---	Trace product
Q	08/26/2002	15:52	---	
Q	11/13/2002	07:30	0.01	Product present
Q	02/11/2003	08:47	---	
Q	05/08/2003	06:48	0.22	
Q	08/27/2003	13:28	---	
Q	10/23/2003	12:03	0.24	
Q	02/19/2004	12:17	---	Trace product
Q	06/09/2004	07:34	---	
Q	08/10/2004	10:52	---	
Q	11/18/2004	08:35	0.25	
Q	02/15/2005	10:46	---	Strong product odor
Q	06/07/2005	19:25	---	
Q	08/16/2005	16:20	---	Strong petro odor
Q	11/14/2005	10:10	---	
LW008S	05/18/1999	14:55	---	
LW008S	09/21/1999	12:24	---	
LW008S	12/06/1999	14:40	---	
LW008S	02/16/2000	10:16	---	
LW008S	05/23/2000	17:42	---	
LW008S	08/29/2000	14:26	---	
LW008S	11/09/2000	13:32	---	
LW008S	02/12/2001	15:58	---	
LW008S	06/04/2001	13:05	---	
LW008S	08/16/2001	12:00	---	
LW008S	11/28/2001	12:57	0.04	
LW008S	02/27/2002	14:37	---	
LW008S	03/05/2002	11:09	---	
LW008S	04/05/2002	08:17	---	
LW008S	05/29/2002	00:00	---	
LW008S	06/27/2002	15:21	---	
LW008S	08/26/2002	16:38	---	
LW008S	11/13/2002	08:50	---	

TABLE 2
LNAPL MEASUREMENTS AND OBSERVATIONS IN GROUNDWATER
QUARTERLY SAMPLING EVENTS, MARCH 1997 - NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Well	Date	Time	LNAPL Thickness (ft)	NOTES
LW008S	02/11/2003	09:48	---	
LW008S	05/08/2003	08:00	---	
LW008S	08/27/2003	14:25	---	
LW008S	10/23/2003	12:42	---	
LW008S	02/19/2004	15:03	---	
LW008S	06/09/2004	08:43	---	
LW008S	08/10/2004	12:05	---	
LW008S	11/18/2004	09:15	---	
LW008S	02/15/2005	09:59	---	
LW008S	06/07/2005	19:51	---	
LW008S	08/16/2005	16:25	---	
LW008S	11/14/2005	09:33	---	
LW011S	05/18/1999	15:10	---	
LW011S	09/21/1999	11:51	---	
LW011S	12/06/1999	15:05	---	
LW011S	02/16/2000	11:01	---	
LW011S	05/23/2000	11:01	---	
LW011S	08/29/2000	14:55	---	
LW011S	11/09/2000	13:36	0.37	First occurrence of product in well.
LW011S	02/12/2001	15:18	---	
LW011S	06/04/2001	13:12	---	
LW011S	08/16/2001	11:24	0.28	
LW011S	11/28/2001	12:51	---	Trace product
LW011S	02/27/2002	14:59	---	
LW011S	03/05/2002	11:40	---	
LW011S	04/05/2002	08:34	---	
LW011S	05/29/2002	00:00	---	
LW011S	06/27/2002	15:09	---	
LW011S	08/26/2002	16:48	---	
LW011S	11/13/2002	08:54	---	
LW011S	02/11/2003	10:03	---	
LW011S	05/08/2003	08:07	---	
LW011S	08/27/2003	14:36	---	
LW011S	10/23/2003	14:12	---	
LW011S	02/19/2004	14:02	---	
LW011S	06/09/2004	08:56	---	
LW011S	08/10/2004	12:08	---	
LW011S	11/18/2004	09:08	0.09	
LW011S	02/15/2005	11:03	---	Product odor
LW011S	06/07/2005	20:05	---	
LW011S	08/16/2005	17:10	---	
LW011S	11/14/2005	08:16	---	
LW021S	10/23/2003	12:16	---	
LW021S	02/19/2004	14:54	1.03	
LW021S	06/09/2004	07:44	0.11	
LW021S	08/10/2004	11:02	0.17	
LW021S	11/18/2004	08:43	0.11	
LW021S	02/15/2005	10:52	0.02	
LW021S	06/09/2005	16:00	0.09	Product observed
LW021S	08/16/2005	17:33	0.16	
LW021S	11/14/2005	10:20	0.04	
LW027S	10/23/2003	12:20	---	
LW027S	02/19/2004	12:44	0.69	
LW027S	06/09/2004	07:39	---	
LW027S	08/10/2004	10:58	0.12	
LW027S	11/18/2004	07:39	0.02	
LW027S	02/15/2005	10:58	0.02	
LW027S	06/06/2005	19:10	0.10	Product observed
LW027S	08/16/2005	16:30	0.03	
LW027S	11/14/2005	10:02	---	Strong petroleum odor
PZ2	06/27/2002	15:18	---	
PZ2	08/26/2002	16:34	---	
PZ2	11/13/2002	08:25	---	
PZ2	02/11/2003	09:44	---	
PZ2	05/08/2003	07:45	---	
PZ2	08/27/2003	14:03	---	
PZ2	10/23/2003	13:21	0.06	
PZ2	02/19/2004	13:50	---	
PZ2	06/09/2004	08:33	---	
PZ2	08/10/2004	12:02	---	
PZ2	11/18/2004	09:20	---	

TABLE 2
LNAPL MEASUREMENTS AND OBSERVATIONS IN GROUNDWATER
QUARTERLY SAMPLING EVENTS, MARCH 1997 - NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

Well	Date	Time	LNAPL Thickness (ft)	NOTES
PZ2	06/07/2005	18:35	---	
PZ2	08/16/2005	15:52	---	
PZ2	11/14/2005	09:20	---	
OX001S	06/27/2002	15:13	---	
OX001S	08/26/2002	16:45	---	
OX001S	11/13/2002	08:30	---	
OX001S	02/11/2003	09:59	---	
OX001S	05/08/2003	08:04	---	
OX001S	08/27/2003	14:38	---	
OX001S	10/23/2003	14:09	---	
OX001S	02/19/2004	14:10	---	
OX001S	06/09/2004	08:45	---	
OX001S	08/10/2004	12:07	---	
OX001S	11/18/2004	09:07	0.03	
OX001S	02/15/2005	11:11	---	Strong product odor
OX001S	06/07/2005	19:35	---	
OX001S	08/16/2005	16:35	---	
OX001S	11/14/2005	08:53	---	
OX002S	06/27/2002	15:12	---	
OX002S	08/26/2002	16:44	---	
OX002S	11/13/2002	08:33	---	New reference elevation September 2002
OX002S	02/11/2003	10:06	---	
OX002S	05/08/2003	08:09	---	
OX002S	08/27/2003	14:33	---	
OX002S	10/23/2003	14:14	0.31	
OX002S	02/19/2004	14:07	---	
OX002S	06/09/2004	08:52	---	New reference elevation July 2004
OX002S	08/10/2004	12:09	---	
OX002S	11/18/2004	09:10	0.13	
OX002S	02/15/2005	11:09	0.03	
OX002S	06/07/2005	20:00	---	
OX002S	08/16/2005	00:00	0.23	
OX002S	11/14/2005	08:09	0.07	Strong odor
OX003S	06/27/2002	15:14	---	
OX003S	08/26/2002	16:42	---	
OX003S	11/13/2002	08:31	---	
OX003S	02/11/2003	09:58	---	
OX003S	05/08/2003	08:03	---	
OX003S	08/27/2003	14:40	---	
OX003S	10/23/2003	14:10	---	
OX003S	02/19/2004	14:09	---	
OX003S	06/09/2004	08:51	---	
OX003S	08/10/2004	12:06	---	
OX003S	11/18/2004	09:13	0.33	
OX003S	02/15/2005	11:18	---	Slight product odor
OX003S	06/07/2005	19:50	---	
OX003S	08/16/2005	17:20	---	
OX003S	11/14/2005	11:23	---	

Notes:

NM Not measured.

NA Not available.

-- No measurable product or odor observed.

* Well Point

(a) Reference Elevation (Ref. Elev) is the north side of the top of the 1.25-, 2- or 4-inch well casing, reference elevation conducted by Zarosinski-Tatone Engineers, Inc., Portland, Oregon. For the river gauge, the reference elevation measured at a marked location on the south side of the dock on the Willamette River.

(b) Depth to water (DTW) measured from surveyed reference elevation [see note (1)].

(c) Where LNAPL thickness measured, groundwater elevation adjusted to account for the presence of LNAPL using the method in "Estimation of Free Hydrocarbon Volume from Fluid Levels in Monitoring Wells" [Lent Groundwater 28(1):57-67].

TABLE 3
SUMMARY OF STORM DRAIN ANALYTICAL RESULTS
TIME OIL NORTHWEST TERMINAL

Location	Lab ID	Date Collected	TOTAL PETROLEUM HYDROCARBONS (a)					PENTACHLOROPHENOL (µg/L)
			Gasoline (mg/L)	Mineral Spirits (mg/L)	Kerosene (mg/L)	Diesel (mg/L)	Lube Oil (mg/L)	
SDM-1	0109005-02	9/4/2001	0.250 U	0.250 U	0.630 U	0.630 U	0.630 U	11.5
	0111183-02	11/30/2001	NA	NA	NA	0.250 U	0.500 U	0.700
	ED34K	2/28/2002	NA	NA	NA	0.3	0.50 U	100
	EG43A	4/5/2002	NA	NA	NA	NA	NA	82
	EN01A	6/27/2002	NA	NA	NA	NA	NA	190
	ES04I	8/28/2002	NA	NA	NA	NA	NA	25
	FU31G	8/27/2003	NA	NA	NA	NA	NA	120 (b)
	FY64A	10/20/2003	NA	NA	NA	NA	NA	43 (b)
	0402113-12	2/23/2004	NA	NA	NA	NA	NA	791 (b)
	0405022-07	5/4/2004	NA	NA	NA	NA	NA	1000 (b)
	0406059-04	6/9/2004	NA	NA	NA	NA	NA	595 (b)
	0408036-10	8/5/2004	NA	NA	NA	NA	NA	158 (b)
	0411066-13	11/11/2004	NA	NA	NA	NA	NA	1.61 (b)
	0502087-10	2/18/2005	NA	NA	NA	NA	NA	7.2 (b)
SDM-2	0109005-01	9/4/2001	0.250 U	0.250 U	0.630 U	0.630 U	0.630 U	0.500 U
	0111183-01	11/30/2001	NA	NA	NA	0.261	0.500 U	0.500 U
	ED34L	2/28/2002	NA	NA	NA	0.25 U	0.50 U	0.46
	EN01B	6/27/2002	NA	NA	NA	NA	NA	0.25 U
	ES04J	8/28/2002	NA	NA	NA	NA	NA	0.30 U
	FY64B	10/20/2003	NA	NA	NA	NA	NA	0.79
RIVER OUTFALL (c)	0210111-01	10/16/2002	NA	NA	NA	NA	NA	5 U
	0408057-01	8/9/2004	NA	NA	NA	NA	NA	0.507 U

U = Indicates compound was analyzed for, but was not detected at the reported sample detection limit.

NA = Not Analyzed

(a) Samples collected in September, 2001 were analyzed using total petroleum hydrocarbon (TPH) method, NWTPH-HCID. Samples collected in November 2001 were analyzed using NWTPH-Dx.

(b) PCP results after October 2002 represent concentrations intercepted by the stormwater intercept system for treatment at the onsite wastewater treatment plant.

(c) River outfall samples only collected when outfall is exposed during quarterly events.

TABLE 4
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVS
SHORELINE WELLS - NOVEMBER 2004 TO NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

	Minimum SLV From Table 3-1 of JSCS	LW036D 0411059-08 11/10/2004	LW036D 0502088-01 02/17/2005	LW036D P5F0441-04 06/08/2005	LW036D P5H0734-08 08/17/2005	LW036D P5K0698-05 11/15/2005	LW037D 0411059-09 11/10/2004	LW037D 0502088-02 02/17/2005	LW037D P5F0441-05 06/08/2005
SEMIVOLATILES (µg/L)									
EPA 8270C									
Bis(2-ethylhexyl)phthalate	0.22 (g)	0.99 U	0.951 U	10.0 U	10.0 U	9.90 U	1.01 U	1.01 U	10.0 U
PAHs (µg/L)									
EPA 8270SIM									
Acenaphthene	0.2	0.0505 U	0.0478 U	0.100 U	0.100 U	0.0990 U	0.054 U	0.0499 U	0.100 U
Fluoranthene	0.2	0.0505 U	0.0478 U	0.100 U	0.100 U	0.0990 U	0.0756	0.0499 U	0.100 U
Fluorene	0.2	0.0505 U	0.0478 U	0.100 U	0.100 U	0.0990 U	0.054 U	0.0499 U	0.100 U
Naphthalene	0.2	0.0505 U	0.0478 U	0.100 U	0.300 U	0.0990 U	0.054 U	0.0499 U	0.100 U
Pyrene	0.2	0.0505 U	0.0478 U	0.100 U	0.100 U	0.0990 U	0.0864	0.0499 U	0.100 U
NWTPH-G (µg/L)									
Gasoline-Range Hydrocarbons	--	100 U	100 U	80.0 U	80.0 U	80.0 U	100 U	100 U	80.0 U
NWTPH-Dx (µg/L)									
Diesel-Range Hydrocarbons	--	252	243 U	250 U	250 U	250 U	250 U	248 U	250 U
TPH-Motor Oil Range	--	580	NA	NA	NA	NA	500 U	NA	NA

TABLE 4
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVS
SHORELINE WELLS - NOVEMBER 2004 TO NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

	Minimum SLV From Table 3-1 of JSCS	LW036D 0411059-08 11/10/2004	LW036D 0502088-01 02/17/2005	LW036D P5F0441-04 06/08/2005	LW036D P5H0734-08 08/17/2005	LW036D P5K0698-05 11/15/2005	LW037D 0411059-09 11/10/2004	LW037D 0502088-02 02/17/2005	LW037D P5F0441-05 06/08/2005
TOTAL METALS (µg/L)									
EPA 6020									
Arsenic	0.014 (g)	1 U	1 U	1.06	1 U	1 U	5.78	1 U	1 U
Chromium	100	5 U	6.4	1 U	1 U	1 U	26.1	7.8	1 U
Copper	2.7	10 U	10 U	2 U	1.11	2 U	19.6	10 U	2 U
Lead	0.54	0.25	0.1 U	1 U	1 U	1 U	9.8	0.728	1 U
Nickel	16	5 U	5 U	2 U	5.61	2 U	11.7	5 U	2 U
Zinc	33	10 U	10 U	5 U	10 U	5 U	50.5	10 U	5 U
DISSOLVED METALS (µg/L)									
EPA 6020									
Arsenic	0.014 (g)	NA	1 U	1 U	1 U	1 U	NA	1 U	1 U
Chromium	100	NA	6	2 U	1 U	1 U	NA	5	2 U
Copper	2.7	NA	10 U	2 U	1 U	2 U	NA	10 U	2 U
	16	NA	5 U	2 U	4.73	2 U	NA	5 U	2 U

TABLE 4
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVS
SHORELINE WELLS - NOVEMBER 2004 TO NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

	Minimum SLV From Table 3-1 of JSCS	LW037D P5H0734-09 08/17/2005	LW037D P5K0698-02 11/15/2005	LW038D 0411059-10 11/10/2004	LW038D 0502088-03 02/17/2005	LW038D P5F0441-03 06/08/2005
SEMIVOLATILES (µg/L)						
EPA 8270C						
Bis(2-ethylhexyl)phthalate	0.22 (g)	10.0 U	9.71 U	0.984 U	0.997 U	10.0 U
PAHs (µg/L)						
EPA 8270SIM						
Acenaphthene	0.2	0.100 U	0.0962 U	0.12	0.0515	0.100 U
Fluoranthene	0.2	0.100 U	0.0962 U	0.05 U	0.0515 U	0.100 U
Fluorene	0.2	0.100 U	0.0962 U	0.19	0.0515	0.100 U
Naphthalene	0.2	0.100 U	0.0962 U	0.08	0.0515 U	0.100 U
Pyrene	0.2	0.100 U	0.0962 U	0.05 U	0.0515 U	0.100 U
NWTPH-G (µg/L)						
Gasoline-Range Hydrocarbons	--	80.0 U	80.0 U	120	100 U	80.0 U
NWTPH-Dx (µg/L)						
Diesel-Range Hydrocarbons	--	250 U	245 U	954	375	250 U
TPH-Motor Oil Range	--	NA	NA	702	NA	NA

TABLE 4
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVS
SHORELINE WELLS - NOVEMBER 2004 TO NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

	Minimum SLV From Table 3-1 of JSCS	LW037D P5H0734-09 08/17/2005	LW037D P5K0698-02 11/15/2005	LW038D 0411059-10 11/10/2004	LW038D 0502088-03 02/17/2005	LW038D P5F0441-03 06/08/2005
TOTAL METALS (µg/L)						
EPA 6020						
Arsenic	0.014 (g)	1 U	1 U	8.67	3.91	4.38
Chromium	100	1.58	1 U	13.8	8	1 U
Copper	2.7	1.96	2 U	10 U	10 U	2 U
Lead	0.54	1 U	1 U	0.2	0.117	1 U
Nickel	16	2.49	2 U	5 U	5 U	2 U
Zinc	33	10 U	5 U	10 U	10 U	5 U
DISSOLVED METALS (µg/L)						
EPA 6020						
Arsenic	0.014 (g)	1 U	1 U	NA	3.7	3.49
Chromium	100	1 U	1 U	NA	7.6	2 U
Copper	2.7	1 U	2 U	NA	10 U	2 U
	16	1.16	2 U	NA	5 U	2 U

TABLE 4
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVS
SHORELINE WELLS - NOVEMBER 2004 TO NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

	Minimum SLV From Table 3-1 of JSCS	LW038D P5H0734-10 08/17/2005	Dup of LW038D Y P5H0734-12 08/17/2005	LW038D P5K0698-03 11/15/2005	Dup of LW038D Y P5K0698-01 11/15/2005	LW039D 0411059-11 11/10/2004	LW039D 0502088-04 02/17/2005	Dup of LW039D Y 0502088-05 02/17/2005	LW039D P5F0441-02 06/08/2005
SEMIVOLATILES (µg/L)									
EPA 8270C									
Bis(2-ethylhexyl)phthalate	0.22 (g)	10.0 U	10.0 U	9.9 U	9.9 U	1.06 U	0.978 U	1.25	10.0 U
PAHs (µg/L)									
EPA 8270SIM									
Acenaphthene	0.2	0.100 U	0.111 U	0.098 U	0.0971 U	0.145	0.061	0.0612	0.100 U
Fluoranthene	0.2	0.100 U	0.111 U	0.098 U	0.0971 U	0.0517 U	0.0509 U	0.051 U	0.100 U
Fluorene	0.2	0.100 U	0.111 U	0.098 U	0.0971 U	0.0517 U	0.0509 U	0.051 U	0.100 U
Naphthalene	0.2	0.200 U	0.222 U	0.098 U	0.0971 U	0.114	0.0509 U	0.051 U	0.100 U
Pyrene	0.2	0.100 U	0.111 U	0.098 U	0.0971 U	0.0517 U	0.0509 U	0.051 U	0.100 U
NWTPH-G (µg/L)									
Gasoline-Range Hydrocarbons	—	80.0 U	80.0 U	80.0 U	80.0 U	133	100 U	100 U	80.0 U
NWTPH-Dx (µg/L)									
Diesel-Range Hydrocarbons	--	250 UJ	250 U	248 U	245 U	455	247 U	758	250 U
TPH-Motor Oil Range	--	NA	NA	NA	NA	520	NA	NA	NA

TABLE 4
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVS
SHORELINE WELLS - NOVEMBER 2004 TO NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

	Minimum SLV From Table 3-1 of JSCS	Dup of LW038D Y LW038D P5H0734-10 08/17/2005	Dup of LW038D Y LW038D P5H0734-12 08/17/2005	Dup of LW038D Y LW038D P5K0698-03 11/15/2005	Dup of LW038D Y LW038D P5K0698-01 11/15/2005	LW039D 0411059-11 11/10/2004	LW039D 0502088-04 02/17/2005	Dup of LW039D Y LW039D 0502088-05 02/17/2005	LW039D P5F0441-02 06/08/2005
TOTAL METALS (µg/L)									
EPA 6020									
Arsenic	0.014 (g)	5.07	4.93	1.64	1.57	10.7	2.92	2.74	1.05
Chromium	100	1 U	1 U	1 U	1 U	12.4	6.3	6.4	1 U
Copper	2.7	1 U	1 U	2 U	2 U	10 U	10 U	10 U	2 U
Lead	0.54	1 U	1 U	1 U	1 U	0.3	0.132	0.1	1 U
Nickel	16	3.34	3.24	2 U	2 U	5 U	5 U	5 U	3.65
Zinc	33	10 U	10 U	5 U	5.12	10 U	10 U	10 U	5 U
DISSOLVED METALS (µg/L)									
EPA 6020									
Arsenic	0.014 (g)	5.86	5.17	1.45	1.51	NA	2.70	3.00	1.16
Chromium	100	1 U	1 U	1 U	1 U	NA	8.8	8.1	2 U
Copper	2.7	1 U	1 U	2.36	2 U	NA	10 U	10 U	2 U
	16	2.96	3.07	2 U	2 U	NA	5 U	5 U	3.11

TABLE 4
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVS
SHORELINE WELLS - NOVEMBER 2004 TO NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

	Minimum SLV From Table 3-1 of JSCS	LW039D P5H0734-11 08/17/2005	LW039D P5K0698-04 11/15/2005
SEMIVOLATILES (µg/L)			
EPA 8270C			
Bis(2-ethylhexyl)phthalate	0.22 (g)	10.0 U	10.0 U
PAHs (µg/L)			
EPA 8270SIM			
Acenaphthene	0.2	0.100 U	0.100 U
Fluoranthene	0.2	0.100 U	0.100 U
Fluorene	0.2	0.100 U	0.100 U
Naphthalene	0.2	0.100 U	0.100 U
Pyrene	0.2	0.100 U	0.100 U
NWTPH-G (µg/L)			
Gasoline-Range Hydrocarbons	--	80.0 U	80.0 U
NWTPH-Dx (µg/L)			
Diesel-Range Hydrocarbons	--	250 U	243 U
TPH-Motor Oil Range	--	NA	NA

TABLE 4
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVS
SHORELINE WELLS - NOVEMBER 2004 TO NOVEMBER 2005
TIME OIL NORTHWEST TERMINAL

	Minimum SLV From Table 3-1 of JSCS	LW039D P5H0734-11 08/17/2005	LW039D P5K0698-04 11/15/2005
TOTAL METALS (µg/L)			
EPA 6020			
Arsenic	0.014 (g)	4.06	7.76
Chromium	100	1 U	1 U
Copper	2.7	1.47	2 U
Lead	0.54	1 U	1 U
Nickel	16	24.3	6.12
Zinc	33	10 U	5 U
DISSOLVED METALS (µg/L)			
EPA 6020			
Arsenic	0.014 (g)	4.59	7.99
Chromium	100	1 U	1 U
Copper	2.7	1 U	2 U
	16	28.3	8.85

U = Indicates compound was analyzed for, but was not detected at the reported sample detection limit.

UJ = The analyte was not detected in the sample; the reported sample detection limit is an estimate.

J = indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Red value indicates exceedance of screening level values (SLVs) from Table 3-1 of Joint Source Control Strategy (JSCS).

Bold indicates detected constituent.

RI Preliminary Screening Levels:

- (a) Oregon Screening Level Values (SLVs) - surface water, aquatic.
- (b) Oregon Screening Level Values (SLVs), surface water - aquatic and Oregon Ambient Water Quality Criteria (AWQC), Tables 20 and 33A, fresh water, acute.
- (c) Oregon AWQC, Tables 20 and 33A, fish consumption only and National Recommended Water Quality Criteria, organism only.
- (d) Site-specific background concentrations (Phase I and II Contaminants of Potential Concern Screening Report, Time Oil Northwest Terminal, Landau Associates, September 10, 1999).
- (e) Oregon Screening Level Values (SLVs), surface water - aquatic and National Recommended Water Quality Criteria, fresh water chronic.
- (f) Oregon AWQC, fresh water acute and fresh chronic.
- (g) Screening level less than laboratory reporting limit.

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	Upper Zone Wells:							
		LW028S P5F0441-09 6/9/2005	LW029S 0411047-02 11/8/2004	LW029S 0502059-02 2/15/2005	LW029S P5F0343-04 6/8/2005	LW029S P5H0625-08 8/15/2005	LW030S 0411047-04 11/8/2004	LW030S 0502059-03 2/15/2005	LW030S P5F0441-07 6/9/2005
TOTAL METALS									
EPA 6010/7000 Series (µg/L)									
Arsenic	0.014	1 U	3.29	2.34	1.96	2.05	14.1	15.5	17
Beryllium	--	1 U			1 U				1 U
Cadmium	0.094	1 U			1 U				1 U
Chromium	100	1 U	16.9	8.8	1 U	1 U	22.9	5.9	1 U
Copper	2.7	2 U	10 U	10 U	2 U	1 U	10 U	10 U	2 U
Lead	0.54	1 U	0.1 U	0.1 U	1 U	1 U	0.76	1.41	1 U
Magnesium	--			2470				3180	
Mercury	0.012	0.20 U			0.20 U				0.20 U
Nickel	16	12.4	5 U	5 U	3.28	2.74	5 U	5 U	2.10
Selenium	5	2 U			2 U				2 U
Silver	0.12	1 U			1 U				1 U
Thallium	--	1 U			1 U				1 U
Zinc	33	5 U	10 U	10 U	5 U	10 U	10 U	10 U	5.60
PETROLEUM HYDROCARBONS									
NWTPH-Dx (mg/L)									
Diesel	--	250 U	360	242 U	250 U	250 U	747	1340	427
Motor Oil	--		503 U				491 U		
Lube Oil	--			484 U				496 U	
NWTPH-G (mg/L)									
Gasoline	--	80 U	100 U	108	80 U	80 U	637	927	225
BTEX									
EPA Method 8260 (µg/L)									
Benzene	0.35	1 U	0.3 U	0.3 U	1 U	1 U	0.3 U	0.3 U	1 U
Ethylbenzene	7.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m,p-Xylene	1.8	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene	13	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	9.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW028S P5F0441-09 6/9/2005	LW029S 0411047-02 11/8/2004	LW029S 0502059-02 2/15/2005	LW029S P5F0343-04 6/8/2005	LW029S P5H0625-08 8/15/2005	LW030S 0411047-04 11/8/2004	LW030S 0502059-03 2/15/2005	LW030S P5F0441-07 6/9/2005
cPAHs									
EPA Method 8270SIM (µg/L)									
Pentachlorophenol	0.3								
Benzo(a)anthracene	0.0018	0.10 U	0.0529 U	0.0507 U	0.10 U	0.10 U	0.0481 U	0.0483 U	0.10 U
Benzo(a)pyrene	0.0018	0.10 U	0.0529 U	0.0507 U	0.10 U	0.10 U	0.0481 U	0.0483 U	0.10 U
Benzo(b)fluoranthene	0.0018	0.10 U	0.0529 U	0.0507 U	0.10 U	0.10 U	0.0481 U	0.0483 U	0.10 U
Benzo(g,h,i)perylene	0.2	0.10 U	0.0529 U	0.0507 U	0.10 U	0.10 U	0.0481 U	0.0483 U	0.10 U
Benzo(k)fluoranthene	0.0018	0.10 U	0.0529 U	0.0507 U	0.10 U	0.10 U	0.0481 U	0.0483 U	0.10 U
Chrysene	0.0018	0.10 U	0.0529 U	0.0507 U	0.10 U	0.10 U	0.0481 U	0.0483 U	0.10 U
Dibenzo(a,h)anthracene	0.0018	0.20 U	0.0529 U	0.0507 U	0.20 U	0.20 U	0.0481 U	0.0483 U	0.20 U
Indeno(1,2,3-cd)pyrene	0.0018	0.10 U	0.0529 U	0.0507 U	0.10 U	0.10 U	0.0481 U	0.0483 U	0.10 U
SVOCs									
EPA Method 8270 (µg/L)									
Pentachlorophenol	0.3	10 U	5.18 U	4.9 U	10 U	6.00 UJ	4.89 U	5.11 U	10 U
2,3,4,6-Tetrachlorophenol	1100								
2,4,5-Trichlorophenol	360	5 U	5.18 U	4.9 U	5 U	5.71 U	4.89 U	5.11 U	5 U
2,4,6-Trichlorophenol	0.24	5 U	5.18 U	4.9 U	5 U	5.71 U	4.89 U	5.11 U	5 U
2,4-Dichlorophenol	29	5 U	3.11 U	2.94 U	5 U	5.71 U	2.93 U	3.06 U	5 U
2-Chlorophenol	15	5 U	1.04 U	0.98 U	5 U	5.71 U	0.978 U	1.02 U	5 U
4-Chloro-3-methylphenol	--	5 U	2.07 U	1.96 U	5 U	5.71 U	1.96 U	2.04 U	5 U
Benzo(a)anthracene	0.0018	5 U	1.04 U	0.98 U	5 U	5.71 U	0.978 U	1.02 U	5 U
Benzo(a)pyrene	0.0018	5 U	1.04 U	0.98 U	5 U	5.71 U	0.978 U	1.02 U	5 U
Benzo(b)fluoranthene	0.0018	5 U	1.04 U	0.98 U	5 U	5.71 U	0.978 U	1.02 U	5 U
Benzo(g,h,i)perylene	0.2	5 U	1.04 U	0.98 U	5 U	5.71 U	0.978 U	1.02 U	5 U
Benzo(k)fluoranthene	0.0018	5 U	1.04 U	0.98 U	5 U	5.71 U	0.978 U	1.02 U	5 U
Chrysene	0.0018	5 U	1.04 U	0.98 U	5 U	5.71 U	0.978 U	1.02 U	5 U
Dibenzo(a,h)anthracene	0.0018	5 U	1.04 U	0.98 U	5 U	5.71 U	0.978 U	1.02 U	5 U
Indeno(1,2,3-cd)pyrene	0.0018	5 U	1.04 U	0.98 U	5 U	5.71 U	0.978 U	1.02 U	5 U

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW030S P5H0625-03 8/15/2005	LW031S 0411052-02 11/9/2004	LW031S 0502056-01 2/14/2005	LW031S P5F0441-11 6/9/2005	LW031S P5H0734-01 8/17/2005	LW032S 0411052-03 11/9/2004	LW032S 0502056-04 2/14/2005	LW032S P5F0343-01 6/8/2005
TOTAL METALS									
EPA 6010/7000 Series (µg/L)									
Arsenic	0.014	14	1.36	1.09	1 U	1.03	30.3	30.2	20.2
Beryllium	--				1 U				1 U
Cadmium	0.094				1 U				1 U
Chromium	100	1 U	18.2	5.6	1 U	1 U	17.5	5 U	1 U
Copper	2.7	1 U	10 U	10 U	2 U	1 U	10 U	10 U	2 U
Lead	0.54	1 U	0.18	0.1 U	1 U	1 U	0.1 U	0.1 U	1 U
Magnesium	--			4170				7200	
Mercury	0.012				0.20 U				0.20 U
Nickel	16	1 U	5 U	5 U	2.40	1.99	5 U	5 U	14.7
Selenium	5				2 U				2 U
Silver	0.12				1 U				1 U
Thallium	--				1 U				1 U
Zinc	33	10 U	10 U	10 U	5 U	10 U	10 U	10 U	5 U
PETROLEUM HYDROCARBONS									
NWTPH-Dx (mg/L)									
Diesel	--	349	568	261	250 U	250 U	4440	3130	562
Motor Oil	--		593				721		
Lube Oil	--			500 U				500 U	
NWTPH-G (mg/L)									
Gasoline	--	271	100 U	100 U	80 U	80 U	2870	4670	971
BTEX									
EPA Method 8260 (µg/L)									
Benzene	0.35	1 U	0.3 U	0.3 U	1 U	1 U	0.3 U	0.3 U	1 U
Ethylbenzene	7.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m,p-Xylene	1.8	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene	13	1 U	1 U	1 U	1 U	1 U	1.6	1 U	1 U
Toluene	9.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW030S P5H0625-03 8/15/2005	LW031S 0411052-02 11/9/2004	LW031S 0502056-01 2/14/2005	LW031S P5F0441-11 6/9/2005	LW031S P5H0734-01 8/17/2005	LW032S 0411052-03 11/9/2004	LW032S 0502056-04 2/14/2005	LW032S P5F0343-01 6/8/2005
cPAHs									
EPA Method 8270SIM (µg/L)									
Pentachlorophenol	0.3								
Benzo(a)anthracene	0.0018	0.10 U	0.0521 U	0.0479 U	0.111 U	0.10 U	0.0489 U	0.0497 U	0.10 U
Benzo(a)pyrene	0.0018	0.10 U	0.0521 U	0.0479 U	0.111 U	0.10 U	0.0489 U	0.0497 U	0.10 U
Benzo(b)fluoranthene	0.0018	0.10 U	0.0521 U	0.0479 U	0.111 U	0.10 U	0.0489 U	0.0497 U	0.10 U
Benzo(g,h,i)perylene	0.2	0.10 U	0.0521 U	0.0479 U	0.111 U	0.10 U	0.0489 U	0.0497 U	0.10 U
Benzo(k)fluoranthene	0.0018	0.10 U	0.0521 U	0.0479 U	0.111 U	0.10 U	0.0489 U	0.0497 U	0.10 U
Chrysene	0.0018	0.10 U	0.0521 U	0.0479 U	0.111 U	0.10 U	0.0489 U	0.0497 U	0.10 U
Dibenzo(a,h)anthracene	0.0018	0.20 U	0.0521 U	0.0479 U	0.222 U	0.20 U	0.0489 U	0.0497 U	0.20 U
Indeno(1,2,3-cd)pyrene	0.0018	0.10 U	0.0521 U	0.0479 U	0.111 U	0.10 U	0.0489 U	0.0497 U	0.10 U
SVOCs									
EPA Method 8270 (µg/L)									
Pentachlorophenol	0.3	5 UJ	4.93 U	4.83 U	10 U	5 UJ	4.96 U	4.93 U	10 U
2,3,4,6-Tetrachlorophenol	1100								
2,4,5-Trichlorophenol	360	5 U	4.93 U	4.83 U	5 U	5 U	4.96 U	4.93 U	5 U
2,4,6-Trichlorophenol	0.24	5 U	4.93 U	4.83 U	5 U	5 U	4.96 U	4.93 U	5 U
2,4-Dichlorophenol	29	5 U	2.96 U	2.9 U	5 U	5 U	2.97 U	2.96 U	5 U
2-Chlorophenol	15	5 U	0.985 U	0.965 U	5 U	5 U	0.991 U	0.986 U	5 U
4-Chloro-3-methylphenol	—	5 U	1.97 U	1.93 U	5 U	5 U	1.98 U	1.97 U	5 U
Benzo(a)anthracene	0.0018	5 U	0.985 U	0.965 U	5 U	5 U	0.991 U	0.986 U	5 U
Benzo(a)pyrene	0.0018	5 U	0.985 U	0.965 U	15 U	5 U	0.991 U	0.986 U	5 U
Benzo(b)fluoranthene	0.0018	5 U	0.985 U	0.965 U	15 U	5 U	0.991 U	0.986 U	5 U
Benzo(g,h,i)perylene	0.2	5 U	0.985 U	0.965 U	15 U	5 U	0.991 U	0.986 U	5 U
Benzo(k)fluoranthene	0.0018	5 U	0.985 U	0.965 U	15 U	5 U	0.991 U	0.986 U	5 U
Chrysene	0.0018	5 U	0.985 U	0.965 U	5 U	5 U	0.991 U	0.986 U	5 U
Dibenzo(a,h)anthracene	0.0018	5 U	0.985 U	0.965 U	15 U	5 U	0.991 U	0.986 U	5 U
Indeno(1,2,3-cd)pyrene	0.0018	5 U	0.985 U	0.965 U	15 U	5 U	0.991 U	0.986 U	5 U

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW032S P5H0701-03 8/16/2005	LW033S 0502099-06 2/22/2005	LW033S P5F0343-03 6/8/2005	LW033S P5H0701-02 8/16/2005	LW034S 0411047-01 11/8/2004	LW034S 0502099-07 2/22/2005	LW034S P5F0441-06 6/9/2005	LW034S P5H0701-01 8/16/2005
TOTAL METALS									
EPA 6010/7000 Series (µg/L)									
Arsenic	0.014	25.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Beryllium	--			1 U				1 U	
Cadmium	0.094			1 U				1 U	
Chromium	100	1 U	7.9	1 U	1 U	5 U	8	1 U	1 U
Copper	2.7	1.17	10 U	2 U	1 U	10 U	10 U	2 U	1 U
Lead	0.54	1 U	0.251	1 U	1 U	0.15	0.1 U	1 U	1 U
Magnesium	--		4700				14000		
Mercury	0.012			0.20 U				0.20 U	
Nickel	16	2.05	5 U	2.70	2.78	5 U	5 U	3.77	3.37
Selenium	5			2 U				2 U	
Silver	0.12			1 U				1 U	
Thallium	--			1 U				1 U	
Zinc	33	10 U	10 U	5 U	10 U	10 U	10 U	5 U	10 U
PETROLEUM HYDROCARBONS									
NWTPH-Dx (mg/L)									
Diesel	--	987	243 U	250 U	250 U	251 U	248 U	250 U	250 U
Motor Oil	--					501 U			
Lube Oil	--		669 U				495 U		
NWTPH-G (mg/L)									
Gasoline	--	807	100 U	80 U	80 U	100 U	100 U	80 U	80 U
BTEX									
EPA Method 8260 (µg/L)									
Benzene	0.35	1 U	0.3 U	1 U	1 U	0.3 U	0.3 U	1 U	1 U
Ethylbenzene	7.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m,p-Xylene	1.8	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene	13	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	9.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW032S P5H0701-03 8/16/2005	LW033S 0502099-06 2/22/2005	LW033S P5F0343-03 6/8/2005	LW033S P5H0701-02 8/16/2005	LW034S 0411047-01 11/8/2004	LW034S 0502099-07 2/22/2005	LW034S P5F0441-06 6/9/2005	LW034S P5H0701-01 8/16/2005
cPAHs									
EPA Method 8270SIM (µg/L)									
Pentachlorophenol	0.3								
Benzo(a)anthracene	0.0018	0.20 U	0.0486 U	0.111 U	0.10 U	0.0498 U	0.0489 U	0.10 U	0.10 U
Benzo(a)pyrene	0.0018	0.20 U	0.0486 U	0.111 U	0.10 U	0.0498 U	0.0489 U	0.10 U	0.10 U
Benzo(b)fluoranthene	0.0018	0.20 U	0.0486 U	0.111 U	0.10 U	0.0498 U	0.0489 U	0.10 U	0.10 U
Benzo(g,h,i)perylene	0.2	0.20 U	0.0486 U	0.111 U	0.10 U	0.0498 U	0.0489 U	0.10 U	0.10 U
Benzo(k)fluoranthene	0.0018	0.20 U	0.0486 U	0.111 U	0.10 U	0.0498 U	0.0489 U	0.10 U	0.10 U
Chrysene	0.0018	0.20 U	0.0486 U	0.111 U	0.10 U	0.0498 U	0.0489 U	0.10 U	0.10 U
Dibenzo(a,h)anthracene	0.0018	0.40 U	0.0486 U	0.222 U	0.20 U	0.0498 U	0.0489 U	0.20 U	0.20 U
Indeno(1,2,3-cd)pyrene	0.0018	0.20 U	0.0486 U	0.111 U	0.10 U	0.0498 U	0.0489 U	0.10 U	0.10 U
SVOCs									
EPA Method 8270 (µg/L)									
Pentachlorophenol	0.3	5 UJ	4.84 U	10 U	5 UJ	5 U	4.81 U	10 U	5 UJ
2,3,4,6-Tetrachlorophenol	1100								
2,4,5-Trichlorophenol	360	5 U	4.84 U	5 U	5 U	5 U	4.81 U	5 U	5 U
2,4,6-Trichlorophenol	0.24	5 U	4.84 U	5 U	5 U	5 U	4.81 U	5 U	5 U
2,4-Dichlorophenol	29	5 U	2.9 U	5 U	5 U	3 U	2.88 U	5 U	5 U
2-Chlorophenol	15	5 U	0.968 U	5 U	5 U	1 U	0.962 U	5 U	5 U
4-Chloro-3-methylphenol	--	5 U	1.94 U	5 U	5 U	2 U	1.92 U	5 U	5 U
Benzo(a)anthracene	0.0018	5 U	0.968 U	5 U	5 U	1 U	0.962 U	5 U	5 U
Benzo(a)pyrene	0.0018	5 U	0.968 U	5 U	5 U	1 U	0.962 U	5 U	5 U
Benzo(b)fluoranthene	0.0018	5 U	0.968 U	5 U	5 U	1 U	0.962 U	5 U	5 U
Benzo(g,h,i)perylene	0.2	5 U	0.968 U	5 U	5 U	1 U	0.962 U	5 U	5 U
Benzo(k)fluoranthene	0.0018	5 U	0.968 U	5 U	5 U	1 U	0.962 U	5 U	5 U
Chrysene	0.0018	5 U	0.968 U	5 U	5 U	1 U	0.962 U	5 U	5 U
Dibenzo(a,h)anthracene	0.0018	5 U	0.968 U	5 U	5 U	1 U	0.962 U	5 U	5 U
Indeno(1,2,3-cd)pyrene	0.0018	5 U	0.968 U	5 U	5 U	1 U	0.962 U	5 U	5 U

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	Lower Zone Wells:							
		LW029D 0411047-03 11/8/2004	LW029D 0502059-01 2/15/2005	LW029D P5F0343-05 6/8/2005	LW029D P5H0625-10 8/15/2005	LW030D 0411047-05 11/8/2004	LW030D 0502059-04 2/15/2005	LW030D P5F0441-08 6/9/2005	LW030D P5H0625-09 8/15/2005
TOTAL METALS									
EPA 6010/7000 Series (µg/L)									
Arsenic	0.014	6.58	8.23	11.1	7.19	12.8	11.4	14.4	14.8
Beryllium	--			1 U				1 U	
Cadmium	0.094			1 U				1 U	
Chromium	100	24	8.8	1.77	3.71	44.2	8.4	13.40	24.5
Copper	2.7	11.5	10 U	2 U	4.58	38.5	10 U	25.8	34.7
Lead	0.54	2.74	1.32	1 U	1.13	7.85	0.81	5.01	7.85
Magnesium	--		35600				18500		
Mercury	0.012			0.20 U				0.20 U	
Nickel	16	5 U	5 U	4.59	5.33	5 U	5 U	15.4	19.7
Selenium	5			2 U				2 U	
Silver	0.12			1 U				1 U	
Thallium	--			1 U				1 U	
Zinc	33	21.6	10 U	8.09	14.10	73.6	10.7	42.1	56.7
PETROLEUM HYDROCARBONS									
NWTPH-Dx (mg/L)									
Diesel	--	252 U	239 U	250 U	250 U	319	370	250 U	250 U
Motor Oil	--	503 U				525 U			
Lube Oil	--		478 U				545		
NWTPH-G (mg/L)									
Gasoline	--	100 U	106	80 U	80 U	100 U	211	80 UJ	80 U
BTEX									
EPA Method 8260 (µg/L)									
Benzene	0.35	0.3 U	0.3 U	1 U	1 U	0.3 U	0.3 U	1 U	1 U
Ethylbenzene	7.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m,p-Xylene	1.8	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene	13	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	9.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW029D 0411047-03 11/8/2004	LW029D 0502059-01 2/15/2005	LW029D P5F0343-05 6/8/2005	LW029D P5H0625-10 8/15/2005	LW030D 0411047-05 11/8/2004	LW030D 0502059-04 2/15/2005	LW030D P5F0441-08 6/9/2005	LW030D P5H0625-09 8/15/2005
cPAHs									
EPA Method 8270SIM (µg/L)									
Pentachlorophenol	0.3								
Benzo(a)anthracene	0.0018	0.0495 U	0.0479 U	0.10 U	0.100 U	0.05 U	0.0508 U	0.10 U	0.10 U
Benzo(a)pyrene	0.0018	0.0495 U	0.0479 U	0.10 U	0.100 U	0.05 U	0.0508 U	0.10 U	0.10 U
Benzo(b)fluoranthene	0.0018	0.0495 U	0.0479 U	0.10 U	0.100 U	0.05 U	0.0508 U	0.10 U	0.10 U
Benzo(g,h,i)perylene	0.2	0.0495 U	0.0479 U	0.10 U	0.100 U	0.05 U	0.0508 U	0.10 U	0.10 U
Benzo(k)fluoranthene	0.0018	0.0495 U	0.0479 U	0.10 U	0.100 U	0.05 U	0.0508 U	0.10 U	0.10 U
Chrysene	0.0018	0.0495 U	0.0479 U	0.10 U	0.100 U	0.05 U	0.0508 U	0.10 U	0.10 U
Dibenzo(a,h)anthracene	0.0018	0.0495 U	0.0479 U	0.20 U	0.200 U	0.05 U	0.0508 U	0.20 U	0.20 U
Indeno(1,2,3-cd)pyrene	0.0018	0.0495 U	0.0479 U	0.10 U	0.100 U	0.05 U	0.0508 U	0.10 U	0.10 U
SVOCs									
EPA Method 8270 (µg/L)									
Pentachlorophenol	0.3	5.05 U	4.79 U	10 U	5 UJ	4.99 U	5.11 U	10 U	5 UJ
2,3,4,6-Tetrachlorophenol	1100								
2,4,5-Trichlorophenol	360	5.05 U	4.79 U	5 U	5 U	4.99 U	5.11 U	5 U	5 U
2,4,6-Trichlorophenol	0.24	5.05 U	4.79 U	5 U	5 U	4.99 U	5.11 U	5 U	5 U
2,4-Dichlorophenol	29	3.03 U	2.88 U	5 U	5 U	2.99 U	3.07 U	5 U	5 U
2-Chlorophenol	15	1.01 U	0.959 U	5 U	5 U	0.997 U	1.02 U	5 U	5 U
4-Chloro-3-methylphenol	—	2.02 U	1.92 U	5 U	5 U	1.99 U	2.04 U	5 U	5 U
Benzo(a)anthracene	0.0018	1.01 U	0.959 U	5 U	5 U	0.997 U	1.02 U	5 U	5 U
Benzo(a)pyrene	0.0018	1.01 U	0.959 U	5 U	5 U	0.997 U	1.02 U	5 U	5 U
Benzo(b)fluoranthene	0.0018	1.01 U	0.959 U	5 U	5 U	0.997 U	1.02 U	5 U	5 U
Benzo(g,h,i)perylene	0.2	1.01 U	0.959 U	5 U	5 U	0.997 U	1.02 U	5 U	5 U
Benzo(k)fluoranthene	0.0018	1.01 U	0.959 U	5 U	5 U	0.997 U	1.02 U	5 U	5 U
Chrysene	0.0018	1.01 U	0.959 U	5 U	5 U	0.997 U	1.02 U	5 U	5 U
Dibenzo(a,h)anthracene	0.0018	1.01 U	0.959 U	5 U	5 U	0.997 U	1.02 U	5 U	5 U
Indeno(1,2,3-cd)pyrene	0.0018	1.01 U	0.959 U	5 U	5 U	0.997 U	1.02 U	5 U	5 U

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW032D 0411052-04 11/9/2004	LW032D 0502056-03 2/14/2005	LW032D P5F0343-02 6/8/2005	LW032D P5H0701-04 8/16/2005
TOTAL METALS					
EPA 6010/7000 Series (µg/L)					
Arsenic	0.014	10.4	9.56	9.59	11.1
Beryllium	--			1 U	
Cadmium	0.094			1 U	
Chromium	100	44.6	9.3	1.75	30
Copper	2.7	30.5	10 U	2.49	34.9
Lead	0.54	5.82	1.3	1.62	8.21
Magnesium	--		31800		
Mercury	0.012			0.20 U	
Nickel	16	13	5 U	2.83	23.6
Selenium	5			2 U	
Silver	0.12			1 U	
Thallium	--			1 U	
Zinc	33	73.4	10 U	9.92	69.2
PETROLEUM HYDROCARBONS					
NWTPH-Dx (mg/L)					
Diesel	--	600	579	250 U	250 U
Motor Oil	--	501			
Lube Oil	--		500 U		
NWTPH-G (mg/L)					
Gasoline	--	105	221	80 U	80 UJ
BTEX					
EPA Method 8260 (µg/L)					
Benzene	0.35	0.3 U	0.3 U	1 U	1 U
Ethylbenzene	7.3	1 U	1 U	1 U	1 U
m,p-Xylene	1.8	2 U	2 U	2 U	2 U
o-Xylene	13	1 U	1 U	1 U	1 U
Toluene	9.8	1 U	1 U	1 U	1 U

TABLE 5
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
BELL TERMINAL TANK FARM WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW032D 0411052-04 11/9/2004	LW032D 0502056-03 2/14/2005	LW032D P5F0343-02 6/8/2005	LW032D P5H0701-04 8/16/2005
cPAHs					
EPA Method 8270SIM (µg/L)					
Pentachlorophenol	0.3				
Benzo(a)anthracene	0.0018	0.0498 U	0.0478 U	0.100 U	0.10 U
Benzo(a)pyrene	0.0018	0.0498 U	0.0478 U	0.100 U	0.10 U
Benzo(b)fluoranthene	0.0018	0.0498 U	0.0478 U	0.100 U	0.10 U
Benzo(g,h,i)perylene	0.2	0.0498 U	0.0478 U	0.100 U	0.10 U
Benzo(k)fluoranthene	0.0018	0.0498 U	0.0478 U	0.100 U	0.10 U
Chrysene	0.0018	0.0498 U	0.0478 U	0.100 U	0.10 U
Dibenzo(a,h)anthracene	0.0018	0.0498 U	0.0478 U	0.200 U	0.20 U
Indeno(1,2,3-cd)pyrene	0.0018	0.0498 U	0.0478 U	0.100 U	0.10 U
SVOCs					
EPA Method 8270 (µg/L)					
Pentachlorophenol	0.3	4.89 U	4.76 U	10 U	6.00 UJ
2,3,4,6-Tetrachlorophenol	1100				
2,4,5-Trichlorophenol	360	4.89 U	4.76 U	5 U	5.56 U
2,4,6-Trichlorophenol	0.24	4.89 U	4.76 U	5 U	5.56 U
2,4-Dichlorophenol	29	2.93 U	2.86 U	5 U	5.56 U
2-Chlorophenol	15	0.978 U	0.952 U	5 U	5.56 U
4-Chloro-3-methylphenol	—	1.96 U	1.9 U	5 U	5.56 U
Benzo(a)anthracene	0.0018	0.978 U	0.952 U	5 U	5.56 U
Benzo(a)pyrene	0.0018	0.978 U	0.952 U	5 U	5.56 U
Benzo(b)fluoranthene	0.0018	0.978 U	0.952 U	5 U	5.56 U
Benzo(g,h,i)perylene	0.2	0.978 U	0.952 U	5 U	5.56 U
Benzo(k)fluoranthene	0.0018	0.978 U	0.952 U	5 U	5.56 U
Chrysene	0.0018	0.978 U	0.952 U	5 U	5.56 U
Dibenzo(a,h)anthracene	0.0018	0.978 U	0.952 U	5 U	5.56 U
Indeno(1,2,3-cd)pyrene	0.0018	0.978 U	0.952 U	5 U	5.56 U

Notes:

mg/L = milligrams per liter (ppm).

µg/L = micrograms per liter (ppb).

U = Indicates the compound was not detected at the given reporting limit.

UJ = Indicates the compound was not detected; the given reporting limit is an estimate.

J = Indicates the compound was identified; the given concentration is an estimate.

Bold font indicates the compound was detected above the laboratory reporting limits.

Red values indicate an exceedance of SLVs from Table 3-1 of Joint Source Control Strategy (JSCS).

TABLE 6
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
PCP PLUME DOWNGRADIENT WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW006D 0411051-07 11/9/2004	LW006D 0502087-06 2/18/2005	LW006D P5F0553-03 6/14/2005	LW006D P5H1000-13 8/23/2005	LW006D P5K0820-06 11/17/2005	LW009D 0411051-02 11/9/2004	LW009D 0502087-07 2/18/2005	LW009D P5F0553-04 6/14/2005
TOTAL METALS									
EPA 6010/7000 Series (µg/L)									
Arsenic	0.014	14	11.3	10.9	14.3	10.80	45.8	32.1	36.6
Beryllium	--			1 U		1 U			1 U
Cadmium	0.094			1 U		1 U			1 U
Chromium	100	18.2	7.7	1 U	2.06	1 U	18.2	8.6	1 U
Copper	2.7	10 U	10 U	2 U	2.98	2 U	10 U	10 U	2 U
Lead	0.54	0.42	0.168 U	1 U	1.20	1 U	0.68	1.44	1 U
Magnesium	--		17200					12900	
Mercury	0.012			0.20 U		0.20 U			0.20 U
Nickel	16	5 U	5 U	4.18	7.55	15.5	5 U	5 U	2.33
Selenium	5			2 U		2 U			2 U
Silver	0.12			1 U		1 U			1 U
Thallium	--			1 U		1 U			1 U
Zinc	33	10 U	10 U	5.23	10 U	8.29	12.4	14.6	8.08
PETROLEUM HYDROCARBONS									
NWTPH-Dx (mg/L)									
Diesel	--	1900	1570	326	383	452 J	289	255 U	250 U
Motor Oil	--	509 U					514 U		
Lube Oil	--		517 U					511 U	
NWTPH-G (mg/L)									
Gasoline	--				918	329		436	109
BTEX									
EPA Method 8260 (µg/L)									
Benzene	0.35	0.3 U	0.3 U	1 U	1 U	1 U	0.3 U	0.3 U	1 U
Ethylbenzene	7.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m,p-Xylene	1.8	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene	13	1.38	1.6	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	9.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

TABLE 6
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
PCP PLUME DOWNGRADIENT WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW006D 0411051-07 11/9/2004	LW006D 0502087-06 2/18/2005	LW006D P5F0553-03 6/14/2005	LW006D P5H1000-13 8/23/2005	LW006D P5K0820-06 11/17/2005	LW009D 0411051-02 11/9/2004	LW009D 0502087-07 2/18/2005	LW009D P5F0553-04 6/14/2005
cPAHs									
EPA Method 8270/8270 SIM (µg/L)									
Benzo(a)anthracene	0.0018	1.04 U	1.02 U	5 U	0.1 U	3.96 U	1 U	1.01 U	5 U
Benzo(a)pyrene	0.0018	1.04 U	1.02 U	5 U	0.1 U	3.96 U	1 U	1.01 U	5 U
Benzo(b)fluoranthene	0.0018	1.04 U	1.02 U	5 U	0.1 U	3.96 U	1 U	1.01 U	5 U
Benzo(g,h,i)perylene	0.2	1.04 U	1.02 U	5 U	0.1 U	3.96 U	1 U	1.01 U	5 U
Benzo(k)fluoranthene	0.0018	1.04 U	1.02 U	5 U	0.1 U	3.96 U	1 U	1.01 U	5 U
Chrysene	0.0018	1.04 U	1.02 U	5 U	0.1 U	3.96 U	1 U	1.01 U	5 U
Dibenzo(a,h)anthracene	0.0018	1.04 U	1.02 U	5 U	0.2 U	3.96 U	1 U	1.01 U	5 U
Indeno(1,2,3-cd)pyrene	0.0018	1.04 U	1.02 U	5 U	0.1 U	3.96 U	1 U	1.01 U	5 U
SVOCs									
EPA Method 8270/8270 SIM (µg/L)									
Pentachlorophenol	0.3	0.495 U	0.607	0.5 U	0.490 U	0.485 U	0.504 U	0.507 U	0.5 U
2,3,4,6-Tetrachlorophenol	1100					19.8 U			
2,4,5-Trichlorophenol	360	5.21 U	5.12 U	5 U	5 U	19.8 U	5.01 U	5.06 U	5 U
2,4,6-Trichlorophenol	0.24	5.21 U	5.12 U	5 U	5 U	19.8 U	5.01 U	5.06 U	5 U
2,4-Dichlorophenol	29	3.12 U	3.07 U	5 U	5 U	11.9 U	3.01 U	3.03 U	5 U
2-Chlorophenol	15	1.04 U	1.02 U	5 U	5 U	3.96 U	1 U	1.01 U	5 U
4-Chloro-3-methylphenol	--	2.08 U	2.05 U	5 U	5 U	7.92 U	2 U	2.02 U	5 U

TABLE 6
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
PCP PLUME DOWNGRADIENT WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW009D P5H1000-12 8/23/2005	LW009D P5K0820-05 11/17/2005
TOTAL METALS			
EPA 6010/7000 Series (µg/L)			
Arsenic	0.014	32.1	32.6
Beryllium	--		1 U
Cadmium	0.094		1 U
Chromium	100	1 U	1.04
Copper	2.7	1 U	2 U
Lead	0.54	1 U	1 U
Magnesium	--		
Mercury	0.012		0.20 U
Nickel	16	1.09	2 U
Selenium	5		2 U
Silver	0.12		1 U
Thallium	--		1 U
Zinc	33	10 U	5 U
PETROLEUM HYDROCARBONS			
NWTPH-Dx (mg/L)			
Diesel	--	250 U	248 U
Motor Oil	--		
Lube Oil	--		
NWTPH-G (mg/L)			
Gasoline	--	127	80 U
BTEX			
EPA Method 8260 (µg/L)			
Benzene	0.35	1 U	1 U
Ethylbenzene	7.3	1 U	1 U
m,p-Xylene	1.8	2 U	2 U
o-Xylene	13	1 U	1 U
Toluene	9.8	1 U	1 U

TABLE 6
COMPARISON OF GROUNDWATER RESULTS TO JSCS SLVs
PCP PLUME DOWNGRADIENT WELLS
NOVEMBER 2004 TO NOVEMBER 2005

	Minimum SLV From Table 3-1 of JSCS	LW009D P5H1000-12 8/23/2005	LW009D P5K0820-05 11/17/2005
cPAHs			
EPA Method 8270/8270 SIM (µg/L)			
Benzo(a)anthracene	0.0018	0.1 U	1.98 U
Benzo(a)pyrene	0.0018	0.1 U	1.98 U
Benzo(b)fluoranthene	0.0018	0.1 U	1.98 U
Benzo(g,h,i)perylene	0.2	0.1 U	1.98 U
Benzo(k)fluoranthene	0.0018	0.1 U	1.98 U
Chrysene	0.0018	0.1 U	1.98 U
Dibenzo(a,h)anthracene	0.0018	0.2 U	1.98 U
Indeno(1,2,3-cd)pyrene	0.0018	0.1 U	1.98 U
SVOCs			
EPA Method 8270/8270 SIM (µg/L)			
Pentachlorophenol	0.3	0.490 U	0.505 U
2,3,4,6-Tetrachlorophenol	1100		9.90 U
2,4,5-Trichlorophenol	360	5 U	9.90 U
2,4,6-Trichlorophenol	0.24	5 U	9.90 U
2,4-Dichlorophenol	29	5 U	5.94 U
2-Chlorophenol	15	5 U	1.98 U
4-Chloro-3-methylphenol	--	5 U	3.96 U

Notes:

mg/L = milligrams per liter (ppm).

µg/L = micrograms per liter (ppb).

U = Indicates the compound was not detected at the given reporting limit.

UJ = Indicates the compound was not detected; the given reporting limit is an estimate.

J = Indicates the compound was identified; the given concentration is an estimate.

Red values indicate an exceedance of SLVs from Table 3-1 of Joint Source Control Strategy (JSCS).

Monitored Natural Attenuation Evaluation

APPENDIX A MONITORED NATURAL ATTENUATION EVALUATION

As part of the source control evaluation, an evaluation was conducted to assess the potential for light non-aqueous phase liquid (LNAPL) from the Main Terminal Tank Farm to migrate and reach the Willamette River. The assessment used monitored natural attenuation (MNA) parameters and fate and transport modeling to determine the migration potential of the LNAPL and evaluate the effectiveness of MNA as a source control option. The MNA parameter results [e.g., pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), nitrate, and sulfate] were used to evaluate the potential for biodegradation to occur under current aquifer conditions. The specific objective of the fate and transport modeling was to assess the potential for an upland petroleum hydrocarbon source, present as LNAPL on upper zone groundwater in the Main Terminal Tank Farm area, to impact the Willamette River after taking into consideration the MNA conditions. The following sections describe the results of the MNA evaluation.

MNA PARAMETER MEASUREMENTS

Water quality parameters, including pH, DO, and ORP, were measured for six months between July and December 2005 at 24 wells within the Main Terminal Tank Farm area and 14 wells within the Bell Terminal Tank Farm area to evaluate MNA processes at the Terminal (Table A-1). The water quality parameters were collected prior to purging the wells using a water quality meter probe inserted into the well. In addition, nitrate and sulfate were sampled and analyzed in select wells in February and August 2005; these results are provided in Table A-2 of this appendix. MNA parameters for the August 2005 event are shown on Figure A-1.

The following paragraphs discuss trends observed in the MNA data. For purposes of the MNA evaluation, the discussion focuses on two groundwater flow paths within the Main Terminal Tank Farm area: the first flow path (flow path 1) includes wells LW-21S (where product has consistently been observed), N (where product has been observed intermittently, but not currently), LW-22D, and LW-36D (shoreline well); the second flow path (flow path 2) includes wells LW-27S (where product has consistently been observed), LW-24D and LW-37D (shoreline well). For both flow paths, well LW-40D (for pH, DO, and ORP) or well LW-1S (for nitrate and sulfate) are included to represent groundwater conditions outside the area of impacted groundwater. The MNA data were evaluated in two ways: 1) concentrations over time and relative to groundwater elevation to determine if there are seasonal influences related to these factors, and 2) concentrations along the two flow paths to assess whether

changes occurred between wells outside and within the area of impacted groundwater (referred to herein as the "plume area").

Generally, pH values ranging from 6 to 8 are considered favorable for microbial populations known to degrade petroleum hydrocarbons (Chevron 1995). The pH measurements collected in the Main Terminal Tank Farm area during the 6-month period between July and December 2005 for the two flow paths ranged from 6.16 to 7.72 (Figures A-2 and A-3), which are within the favorable range for biodegradation to occur. A rise or fall in pH values within the area of the dissolved phase plume for petroleum hydrocarbons (e.g., gasoline- and diesel-range), as compared to the area outside the dissolved phase plume, may be indicative of biodegradation since respiration and decomposition processes have a tendency to alter pH. As shown on Figures A-1 through A-5, pH values in the downgradient shoreline wells tend to have higher pH values than those within the area of dissolved phase contamination for most of the measurement events, particularly for flow path 2. Values in well LW-40D located outside the area of impacted groundwater are less definitive in determining trends along the flow paths. The pH values may indicate that biodegradation is occurring; however, because there is not a definitive indication of change in pH values between wells inside and outside of the dissolved plume area, pH cannot be used to conclusively determine MNA conditions.

A reduction in the concentration of DO in groundwater within the dissolved phase plume, as compared to the area outside the dissolved phase plume, can also be indicative of biodegradation processes occurring, since microbes utilize oxygen during aerobic biodegradation of petroleum hydrocarbons (Chevron 1995). Aerobic biodegradation can typically occur at concentrations as low as 1.0 mg/L; a DO concentration below 0.5 mg/L typically indicates an environment more suitable for anaerobic degradation (EPA 1995). The DO concentrations measured in the Main Terminal Tank Farm area between July and December 2005 (Figures A-6 through A-9) indicate that groundwater within the area of dissolved petroleum contamination (with exceptions during the July 22, 2005 event) is predominantly in an anaerobic state (DO less than 0.5 mg/L) and is slightly aerobic (DO greater than 1.0 mg/L) within the wells outside the area of impacted groundwater (Figures A-8 and A-9). The slightly aerobic conditions in the shoreline wells may also be a reflection of the influence by the river water chemistry during periods of river recharge which may create a more oxygen-rich environment. As shown on Figures A-8 and A-9, DO concentrations tend to decrease as the groundwater passes through the area of dissolved contamination and then "rebound" at the downgradient locations outside of the area of contamination and near the river, which may be indicative of aerobic biodegradation occurring during this time period. For some events, the DO appears to represent more anaerobic conditions (August 30 and October 26, 2005 events), as reflected by the less dramatic change in DO between the wells within and outside of the area of impacted groundwater. The nitrate and sulfate results provide further evidence of

anaerobic biodegradation, as discussed below. The variability in DO concentrations over time between measurement events may reflect some seasonal fluctuations as demonstrated by the slight correlation between the DO measurements and groundwater elevations, but may also reflect some equipment variability because of instrument sensitivity (Figures A-6 and A-7). These observations are supporting evidence that biodegradation processes are likely occurring within the area where petroleum hydrocarbons are observed in groundwater.

Following depletion of DO in a system, nitrate may be used as an anaerobic electron acceptor for biodegradation through the process of denitrification. Similar to DO, areas within the dissolved phase plume with lowered nitrate concentrations, compared to background, would indicate that anaerobic biodegradation is occurring in those areas. After DO and nitrate have been depleted, sulfate may be used as an anaerobic electron acceptor for anaerobic biodegradation via sulfate reduction. During the process of sulfate reduction, sulfide is produced and sulfate concentrations in groundwater decrease within the dissolved phase plume. Nitrate and sulfate concentrations were measured during events in February and August 2005 for wells along an approximate groundwater flow path between wells LW-1S and LW-36D (Figures A-1 and A-10 and Table A-2). Well LW-1S represents upgradient conditions, wells LW-21S, N, P, Q represent conditions within the dissolved plume (the extent of the benzene plume is shown on Figure A-10), and wells LW-22D and LW-36D represent conditions downgradient of the plume. As shown on Figure A-10, nitrate and sulfate concentrations decrease dramatically between the upgradient well (LW-1S) and within the plume area (N). For the August 2005 event, a rebound in nitrate and sulfate concentrations is also evident downgradient of the plume in the shoreline well. These results likely indicate that anaerobic biodegradation was occurring during this time frame. For the February 2005 event, nitrate concentrations were not detected within the plume area and at the downgradient wells, while sulfate increases dramatically in the downgradient well and then decreases again at the shoreline well. These results may indicate that anaerobic biodegradation processes may have sufficiently depleted the limited amount of nitrate available in the groundwater which precludes denitrification processes from being an effective means of anaerobic biodegradation. However, based on the upgradient and downgradient concentrations of sulfate, anaerobic biodegradation utilizing sulfate reduction may be an ongoing process. The decrease in the sulfate concentration at the shoreline well may indicative of the influence of dilution from river water. Other anaerobic biodegradation processes (e.g., iron reduction and methanogenesis) have not been fully evaluated and may provide additional means for decreasing petroleum impacts.

The ORP measured in groundwater is generally positive under oxidizing conditions and negative under reducing conditions (Chevron 1995). As biodegradation occurs and oxygen is consumed, the groundwater becomes more reducing and the ORP of the water decreases. Therefore, a decrease in ORP

values within the area of a dissolved phase plume, as compared to the area outside the dissolved phase plume should indicate the occurrence of aerobic biodegradation. As would be expected with low DO concentrations, ORP measurements were typically negative throughout the terminal, indicating mostly reducing conditions in the upper and lower zones with the higher values occurring at locations closer to the river and outside the area where petroleum constituents were detected in groundwater, and the lower values occurring within the area where petroleum constituents are detected (Figure A-11 through A-14). As shown on Figures A-13 and A-14 for the two flow paths described earlier, ORP measurements in the shoreline wells located closest to the river (LW-36D, LW-37D) and in wells located outside of the dissolved phase plume (e.g., LW-40D) typically tend to be higher than those within the plume area or at locations where petroleum constituents are observed at detected concentrations, indicating that groundwater is in a reduced state. Similar to DO, the wells adjacent to the river may be influenced by river recharge which may create more oxidizing conditions, and the wells outside of the plume area may be more oxidative because of the higher DO concentrations.

The combined results for the MNA parameters indicate that anaerobic biodegradation processes (and possibly some aerobic biodegradation during certain times of the year) have occurred within the areas where petroleum hydrocarbons are observed in upper and lower zone groundwater within the Main Terminal Tank Farm area. The biodegradation processes appear to have attenuated migration of LNAPL and petroleum constituents before reaching downgradient locations near the point of groundwater discharge to the river. Additional MNA measurements are necessary to determine whether anaerobic biodegradation will continue without augmentation of the supply of electron acceptors.

FATE AND TRANSPORT MODELING

To evaluate whether there is a potential for LNAPL observed in upland wells to migrate to the river, a fate and transport model was used that takes into account the effects of natural attenuation. A description of the model software and the modeling results are provided in the following sections. The results of the model are then used with the results of the MNA measurements to assess whether there is a potential for natural attenuation to prohibit migration of LNAPL from the Main Terminal Tank Farm area to the river.

Description of Natural Attenuation Software

The Natural Attenuation Software (NAS) model was used for the fate and transport modeling for the MNA evaluation (Widdowson et. al). The NAS model was developed by Virginia Institute of Technology and the United States Geological Survey for the U.S. Navy, and was designed to calculate the

period of time required to achieve site-specific remediation goals at sites contaminated with either fuels or chlorinated solvents. The NAS model can be used to estimate distance of stabilization (DOS), time of stabilization (TOS) or time of remediation (TOR) for a particular contaminant. The DOS function can be used to estimate a required target source concentration to meet preliminary screening levels at a designated point of compliance within the required time for the plume to meet the screening levels after a source cleanup. The TOS function can be used to estimate the maximum distance from the source at which preliminary screening levels can be met without remediation. The TOR function can also be used to estimate the required time to meet preliminary screening levels in the source area with or without partial or full removal of LNAPL.

The following parameters are entered into the model:

- Site specific hydrogeology (hydraulic conductivity, hydraulic gradient, total porosity, effective porosity, and groundwater velocity)
- MNA parameters (e.g., DO, nitrate, and sulfate)
- Contaminant concentrations (benzene, toluene, ethylbenzene, xylenes, and naphthalene)
- Preliminary screening levels at the point of compliance (for the model, equivalent to the JSCS screening levels at the shoreline wells).

The model estimates groundwater flow rates, biodegradation rates, and sorption properties. Analytical solutions are used to calculate the DOS/TOS. Using the preliminary screening levels at the point of compliance, the NAS model calculates the maximum allowed source zone concentration and estimates the required time (TOS) to reach that concentration after the source area has been remediated. In contrast, a numerical solution (SEAM3D and MODFLOW) is used for the TOR approach to determine the required time for LNAPL to dissolve and a source compliance concentration to be reached with or without partial or full removal of the LNAPL.

NAS MODEL PARAMETERS AND ASSUMPTIONS

Site-specific data, including hydraulic conductivity, hydraulic gradient, and porosity, collected during the Phase II and Phase III remedial investigations (RI) was used for the model. Previous field data collected during the Phase II RI was used to approximate the hydrogeologic conditions. Hydraulic conductivity data that were previously estimated through slug/bail tests and pumping tests were used in the model, including a minimum value of 44 ft/d, a maximum of 156 ft/d, and an average value of 82.3 ft/day (Landau Associates 2001). The overall horizontal hydraulic gradient was established by estimating the gradient between the wells along the pathway for the August 2005 event. The minimum and maximum values (0.0014 and 0.0158 ft/ft, respectively) were directly used for the model. The average

for the entire flow path (0.009 ft/ft) was estimated by calculating the average for the upper and lower zone along the pathway and thereafter predicting a normalized total value. Furthermore, total organic carbon (soil) measured in March 1997 at LW-006D (0.084%) and LW-001S (0.65%) was used as the best estimate for the model. Freeze and Cherry (1979) estimates the total porosity of sand to be between 0.25 and 0.50, and for this model a porosity of 0.4 was chosen. The effective porosity number chosen was 0.3, as estimated in the Phase II RI report (Landau Associates 2001) for calculation of groundwater velocities. For the purposes of the model, the source zone was estimated to have a length and width of 50 ft for both N and LW-21S. Boring logs and groundwater elevation data history was utilized to determine the source depth which was estimated to be equivalent to the saturated thickness of the upper zone, 4.55 ft at LW-021S and 2.31 ft at N.

Similar to the evaluation for the MNA parameters, a groundwater flow path (flow path 1), including wells LW-21S (where LNAPL is currently observed), N, P, and Q (where LNAPL has historically been observed), LW-22D, and LW-36D was used. The point of compliance was considered as the shoreline well (LW-36D), located downgradient of wells LW-21S, N, P, Q, and LW-22D. Flow path 2, used for the MNA parameter discussion in the previous section, was not used for the fate and transport model because two of the three wells along the flow path had nondetected concentrations of BTEX and naphthalene and the model could not run reliably with these concentrations.

Using flow path 1, two model scenarios were run: one scenario where well LW-21S was considered representative of the source zone, and a second scenario where well N was considered representative of the source zone. The source zone wells were chosen based on the historical or current presence of LNAPL in these wells and their location upgradient of the point of compliance well. For the purposes of the model, the area including the wells within the flow path was assumed to be a single hydrogeologic unit (i.e., not to be divided into an upper and lower zone) under the assumption that upper zone groundwater in the area where LNAPL is observed flows across the confining unit into the lower zone and discharges to the river near where the point of compliance well is located. Model parameters and model results are presented in Appendix B.

For the purposes of the model, the remediation goals are analogous to the JSCS SLVs for BTEX and naphthalene, as presented in the following table.

JSCS SLVS USED AT POINT OF COMPLIANCE, WELL LW-36D

Compound	JSCS SLVs (µg/L) ^a
Benzene	5.1
Toluene	9.8
Ethylbenzene	7.3
Xylenes	13
Naphthalene	0.2

(a) DEQ and EPA 2005

Product has consistently been detected in well LW-21S and therefore, groundwater samples have not been collected and BTEX and naphthalene have not been measured. The NAS model does not estimate transportation of LNAPL; therefore, saturated aqueous concentrations for the constituents were assumed and used in the model. Five different sets of contaminant data measured between August 2004 and November 2005 were used to set up the model. The data collected in during the August 2005 (third quarter) sampling event was mainly used for this discussion, because that event included the largest and most complete data set.

The August 2005 MNA data indicate very low levels of oxygen and nitrate at concentrations near or below the laboratory reporting limit; sulfate concentrations are low within the area of impacted groundwater, but increase at the wells located upgradient and downgradient of the impacted area (Figures A-1 and A-10). These data indicate that sulfate-reducing anaerobic biodegradation processes may be occurring along the flow path and the higher concentrations of petroleum constituents correlate with the lowest concentrations of sulfate. It is possible that two redox zones exist in the area of the plume, and measured data at other dates have indicated that slightly aerobic zones might exist outside the area of impacted groundwater or at the shoreline well (LW-36D), possibly due to river influences. However, using redox data from only five wells, NAS will be able to provide the best approximation if the area is treated as one zone. For example, if only LW-36D is considered aerobic in the model, NAS tries to calculate the decay rate for that condition, but with only one well in the aerobic zone the model extrapolates from that point using only one point, and can therefore not produce reliable results.

After data along the pathway is entered into the NAS model, the model is used to estimate if the preliminary screening levels (JSCS SLVs) would be met at the point of compliance, which would be the case if the DOS was less than the distance between the source and the point of compliance. If the model estimates that they will not be met, the next step for NAS is to estimate reduction goals at the source zone and the time requirement after reduction until 50 percent breakthrough and equilibrium has been met at

the point of compliance (TOS). If a known amount of NAPL exists at the source zone, an option is to calculate the time to reach a chosen aqueous concentration after a known amount of NAPL is removed from the source zone (TOR).

NAS MODEL RESULTS

The NAS model results indicate that no reduction in concentrations of the compounds modeled at any wells along the designated pathway (LW-21S, N, P, Q, LW-22D) is required to meet preliminary screening levels at LW-36D, whether the source well is considered to be LW-21S or N (Appendix B). Well N is located about 225 ft closer to the river along the groundwater flow path than LW-21S. The contaminant data supports this conclusion, showing a rapid consistent decay of total BTEX and petroleum constituents along the flow path. This conclusion is also supported by the MNA parameter data that indicate that anaerobic biodegradation (sulfate reduction) is likely occurring within the area of the dissolved contamination.

Furthermore, to test the sensitivity for measurement errors and other factors that might influence the results, a few different scenarios were evaluated. The hydraulic conductivity, hydraulic gradient, source volume and contaminant concentrations were each increased by 20, 50 and 100 percent. The output results were still the same (i.e., no reduction in groundwater concentrations required). In addition, contaminant concentrations for well LW-36D were excluded to evaluate if the model would be more conservative, but the results still indicated that no reduction in groundwater concentration is required. Finally, different redox conditions were chosen (still only using one zone, i.e., same condition in all wells) with no change in the results.

Because the model predicts that no reduction in concentration is required to meet the preliminary screening levels, TOS and TOR are not estimated. The DOS was determined for individual BTEX constituents and naphthalene using both wells LW-21S and N to represent the source zone. As shown on Figures A-15 through A-24, in every case the model predicts that the distances between the source zone and where preliminary screening levels are estimated to be met are less than the distance between the source and the point of compliance or shoreline well. Using well LW-21S to represent the source zone, with the distance between the source zone and the point of compliance equal to about 440 ft, predicted DOS values ranged from 240 to 360 ft. Using well N to represent the source zone, with the distance between the source zone and the point of compliance equal to about 265 ft, predicted DOS values ranged from about 32 to 130 ft. The use of saturated aqueous concentrations for contaminants within the source zone at LW-21S versus measured groundwater concentrations at N is likely the reason why the predicted DOS values are greater for the case where the source zone is farthest from the point of compliance.

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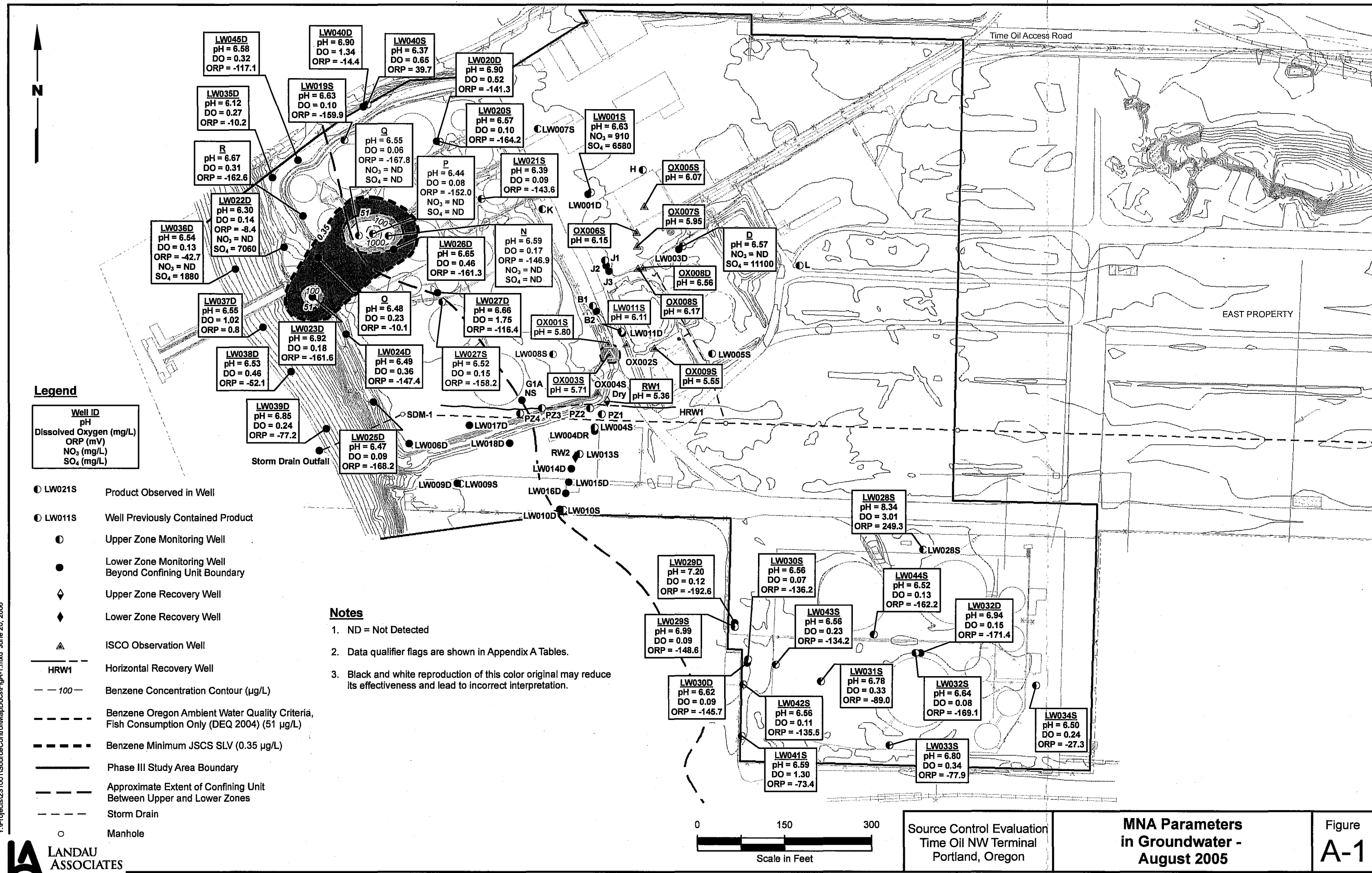
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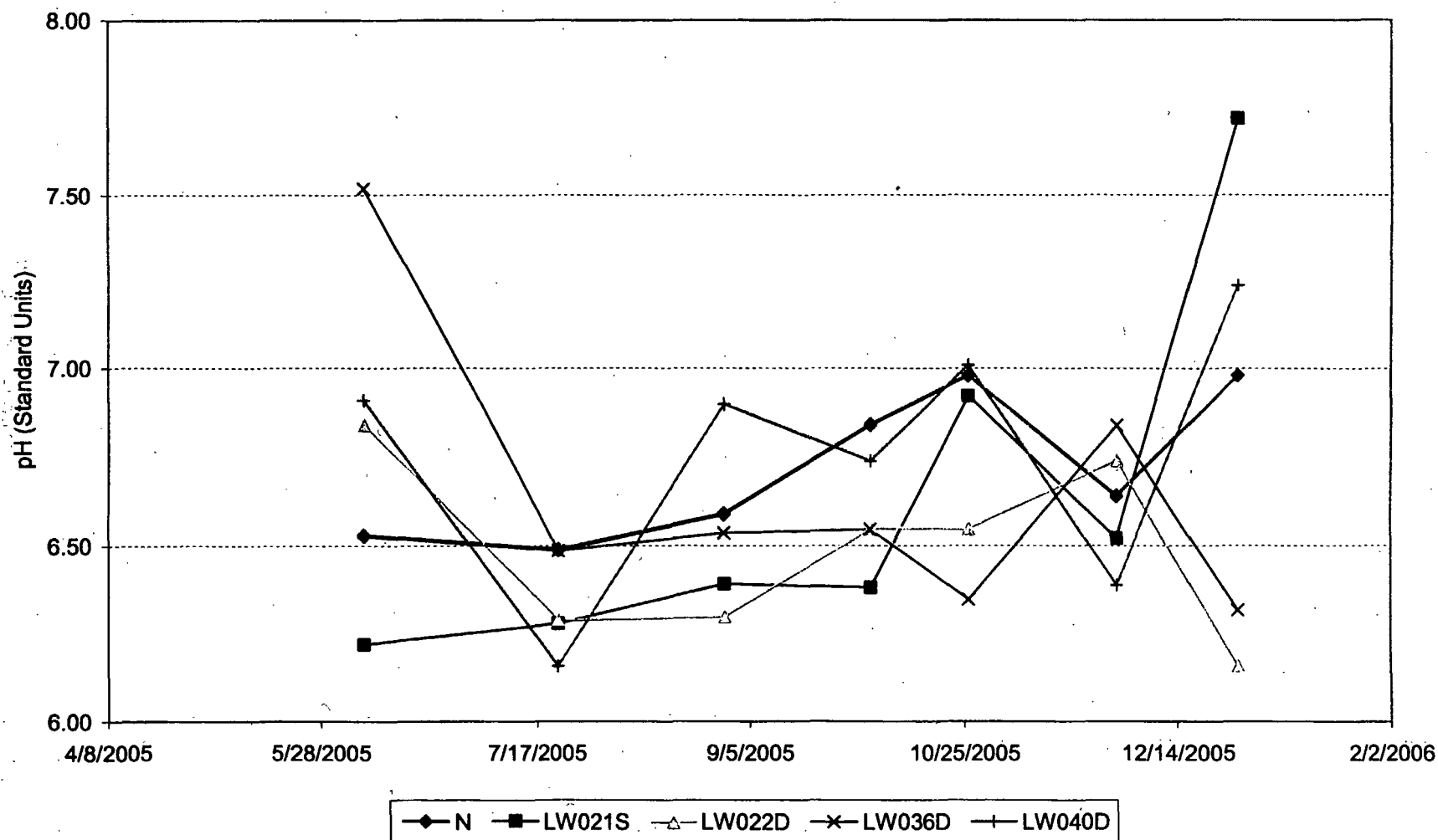
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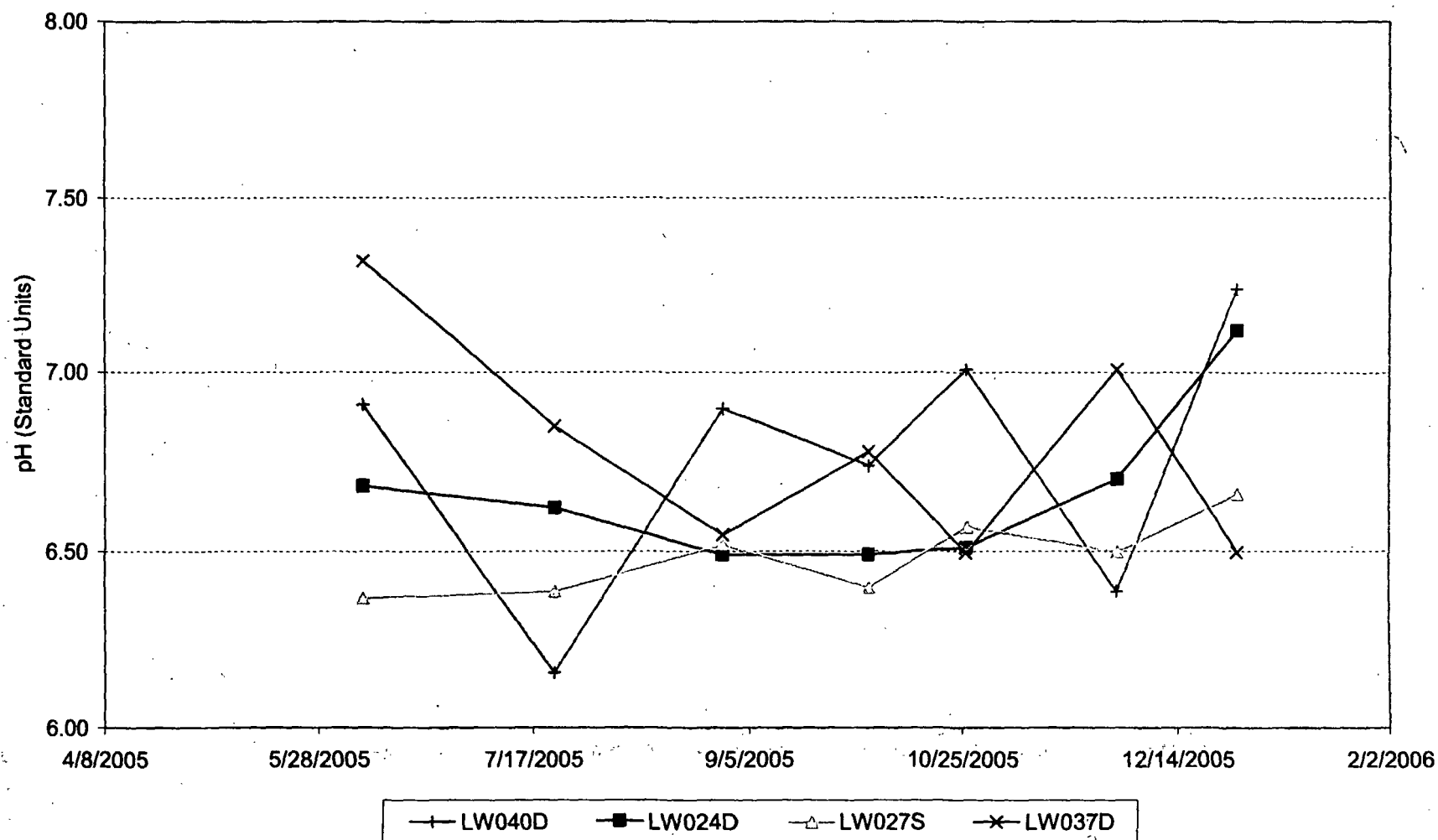


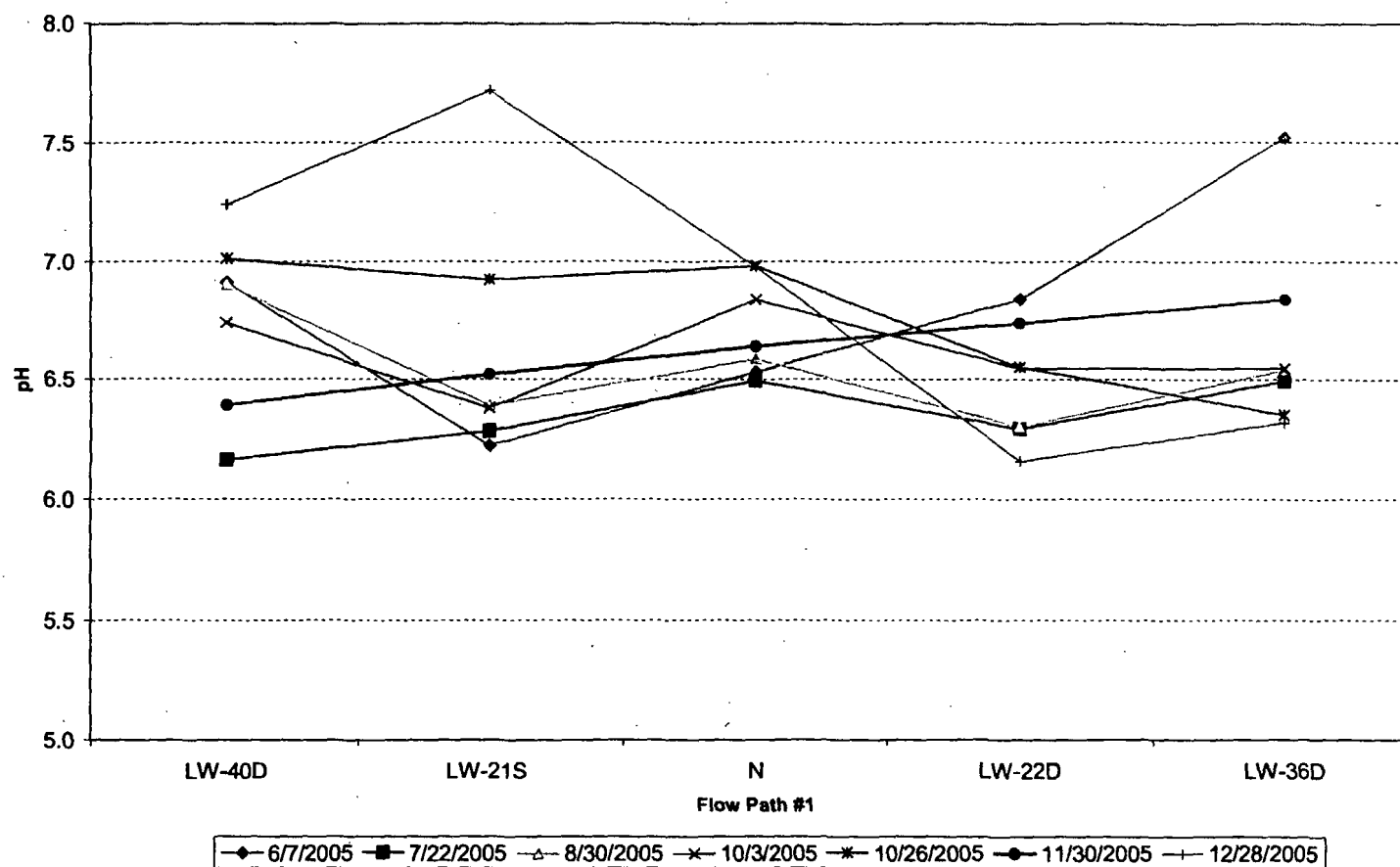
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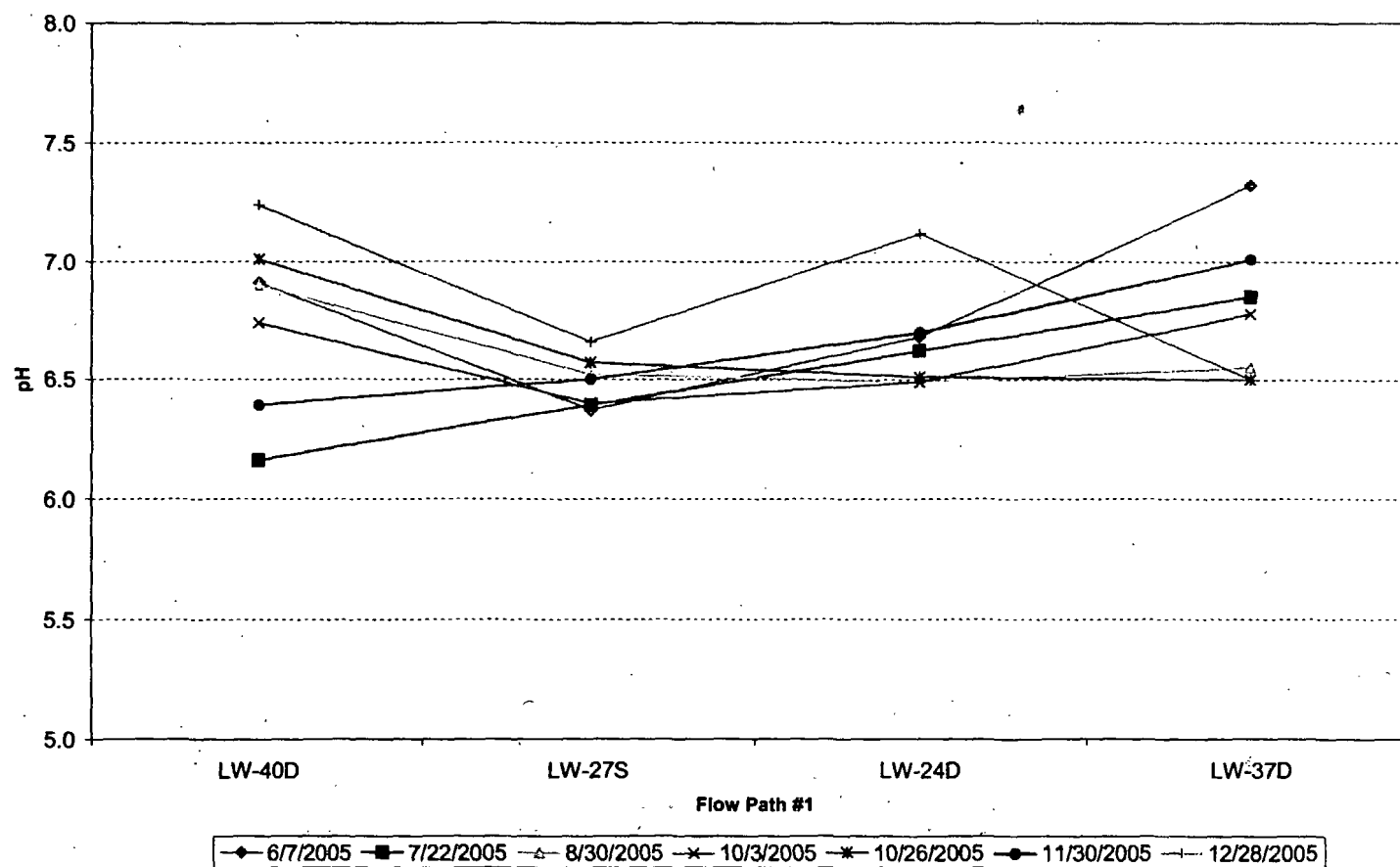
Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

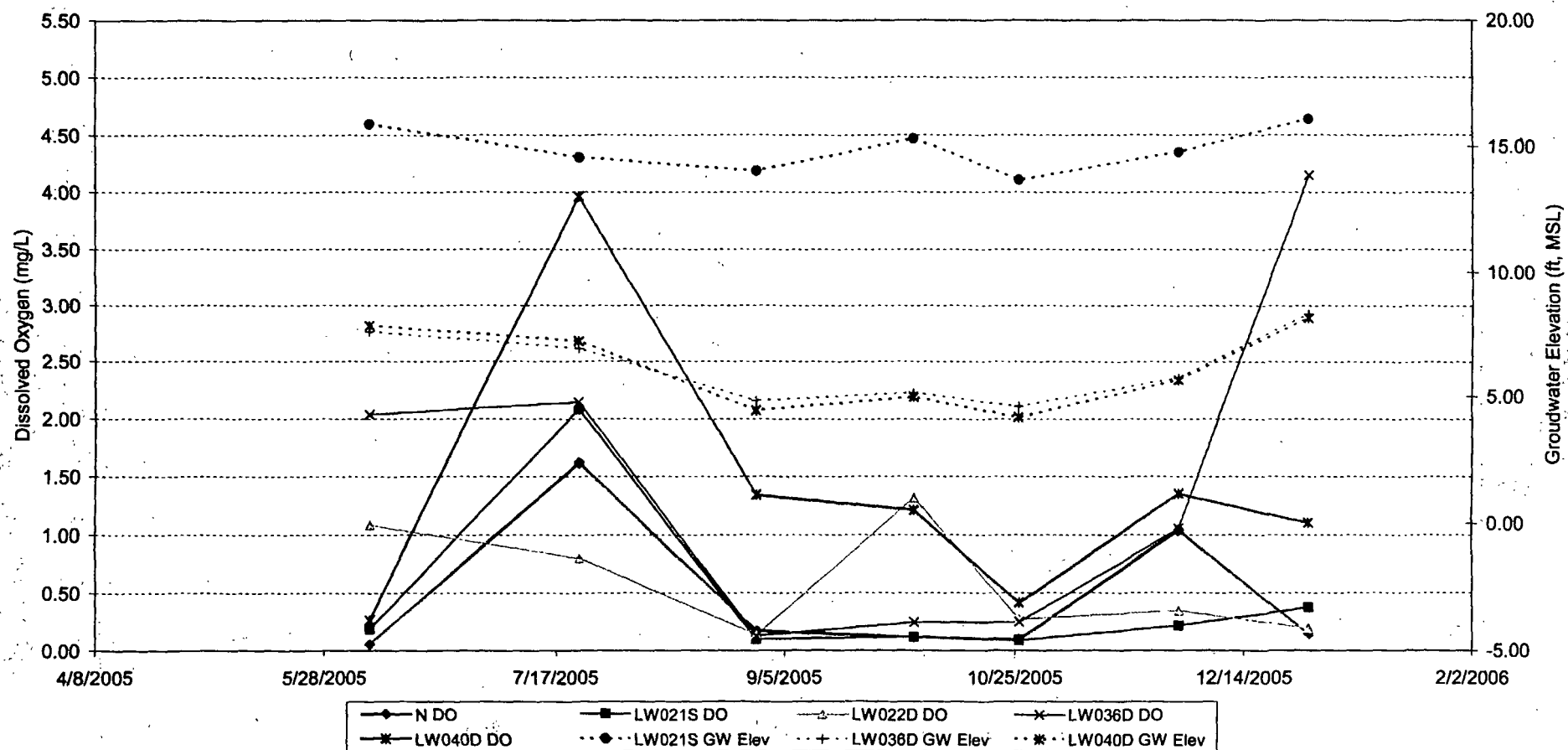
pH Values, June-December 2005
Flow Path 1

Figure
A-2





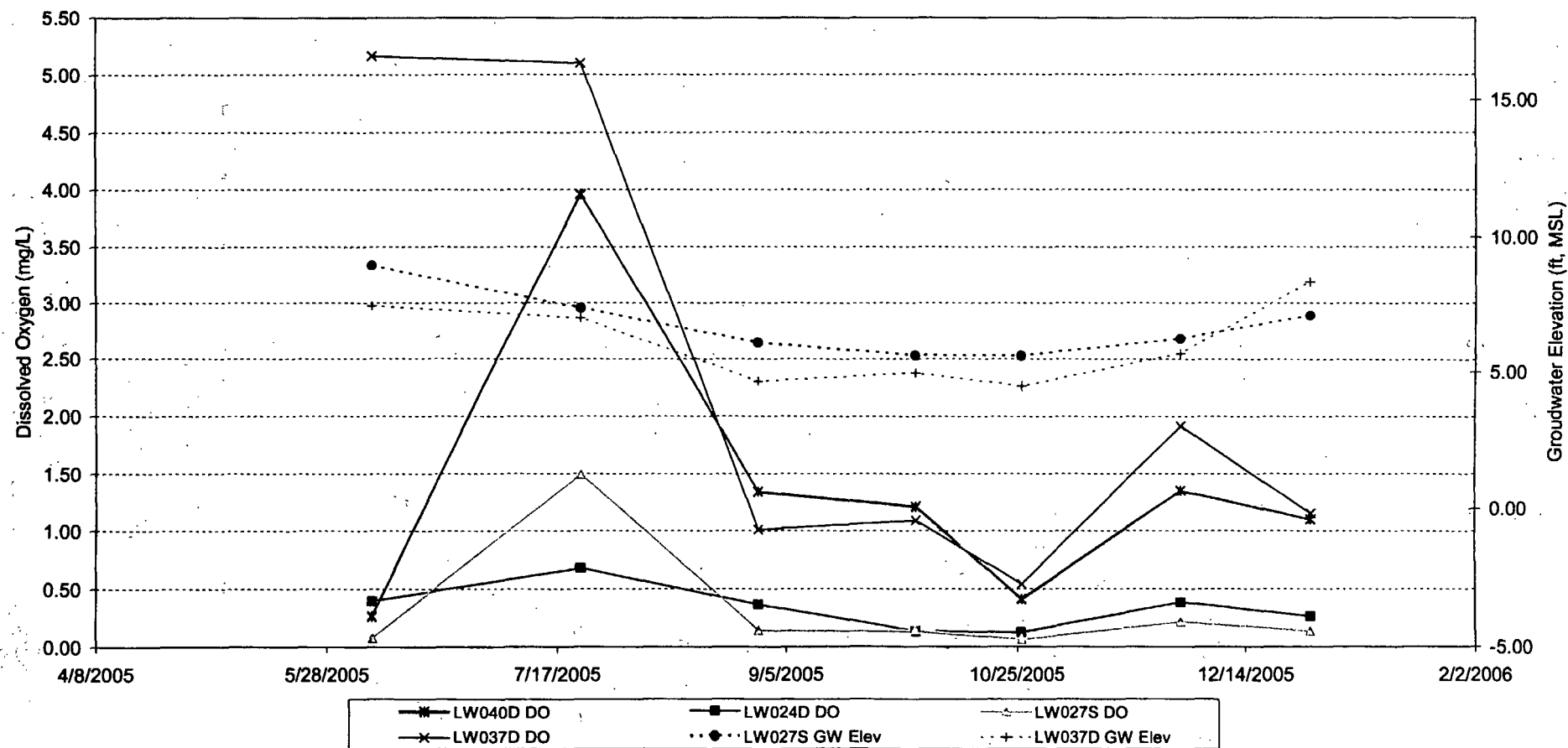


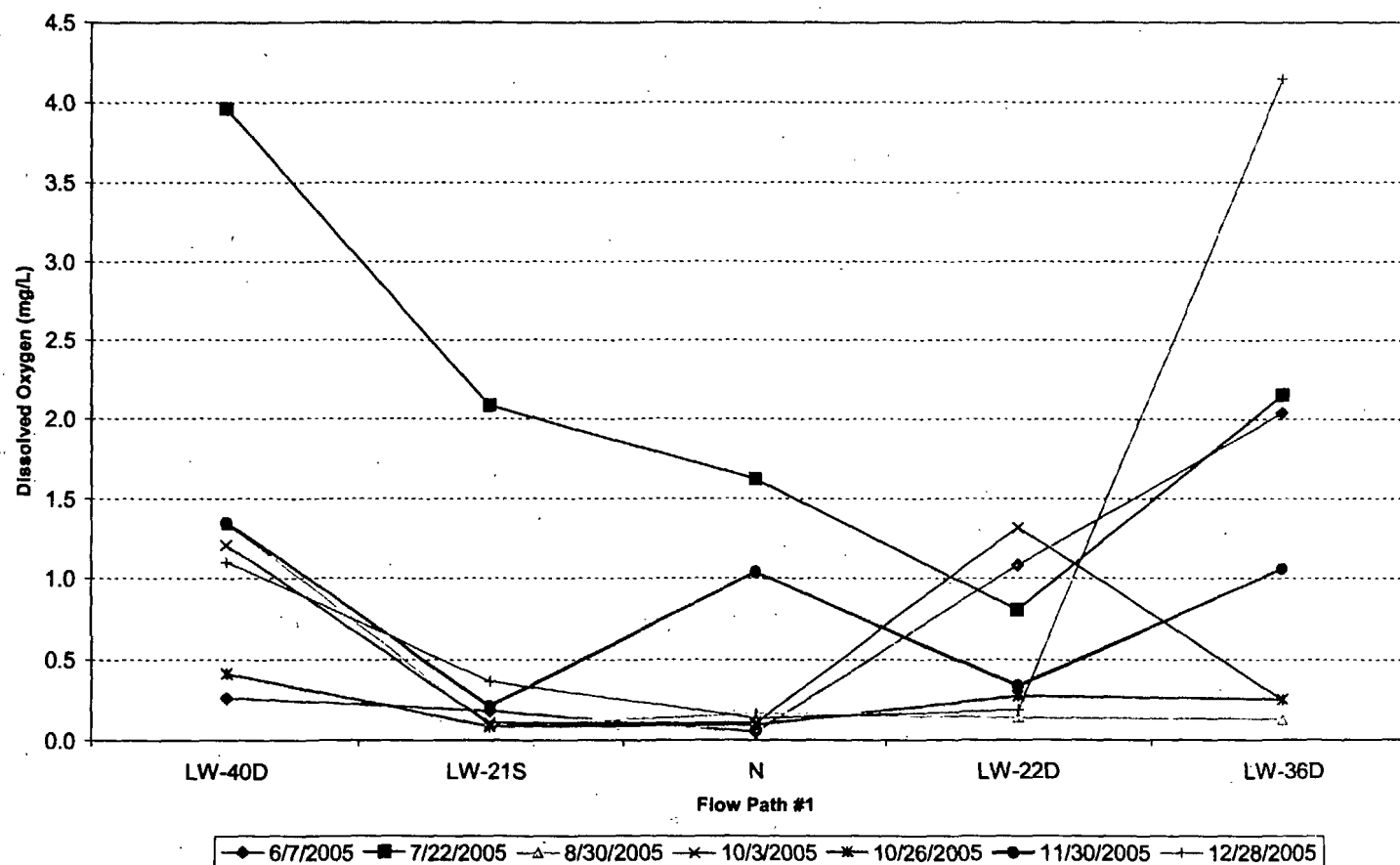


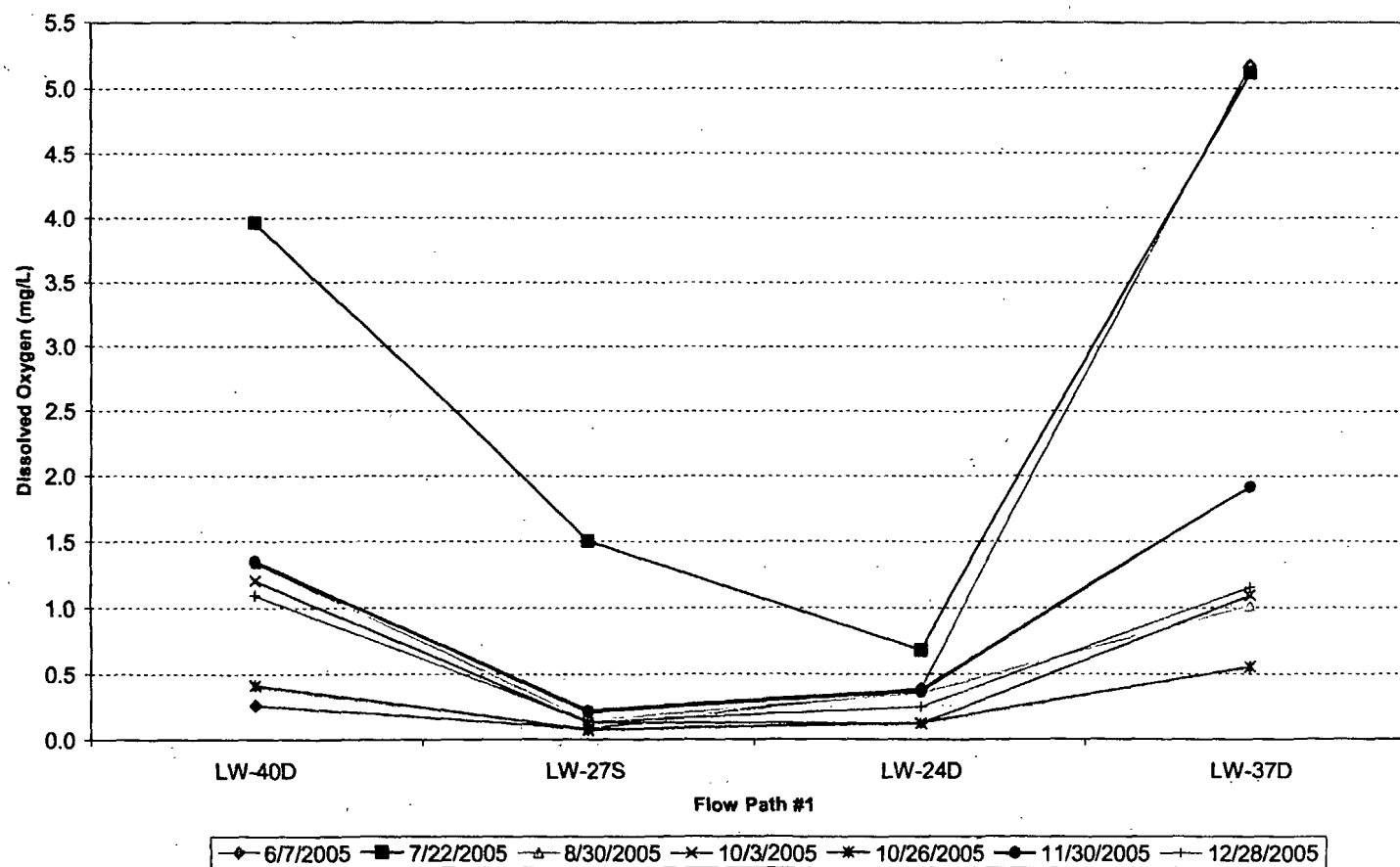
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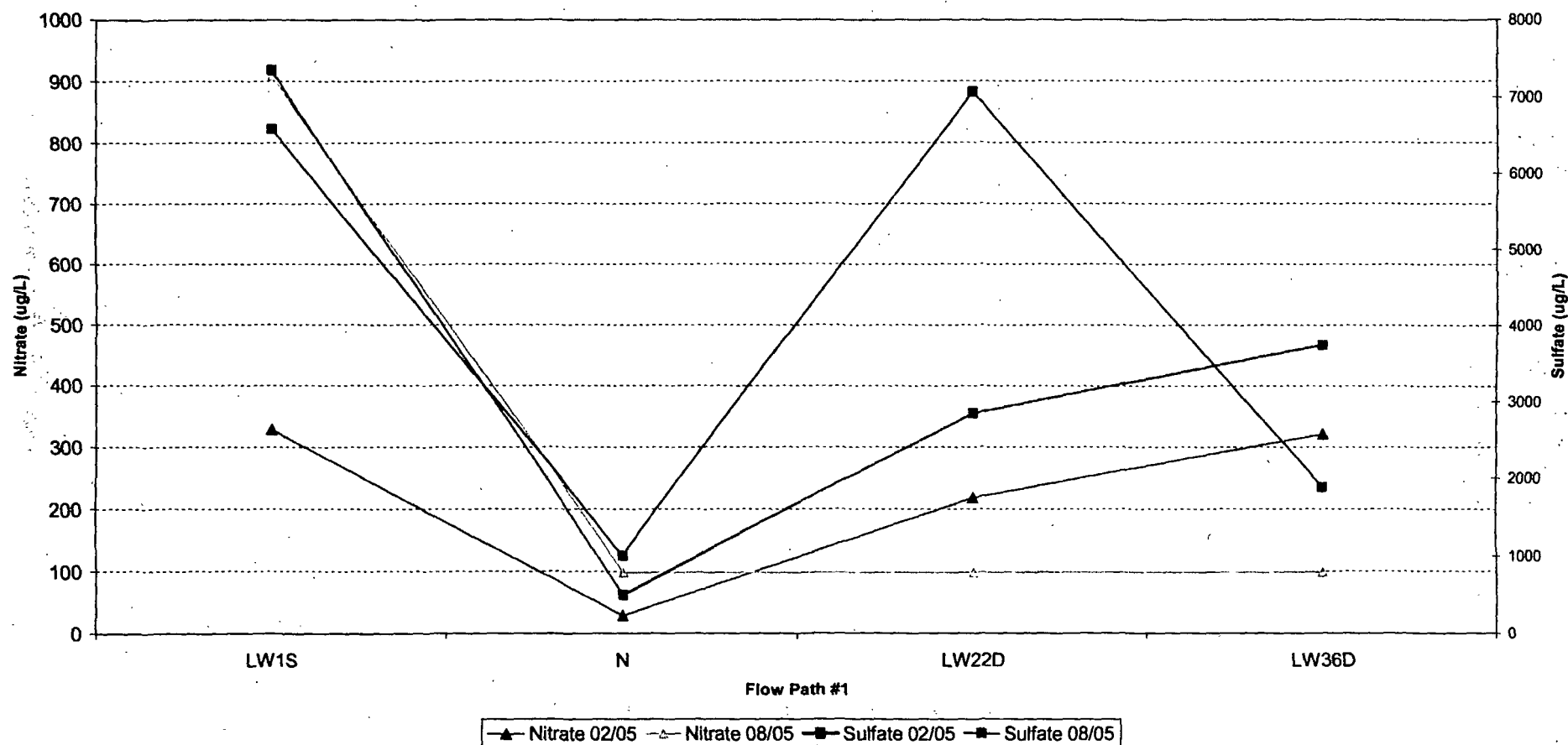
Dissolved Oxygen vs. Time
June-December 2005, Flow Path 1

Figure
A-6





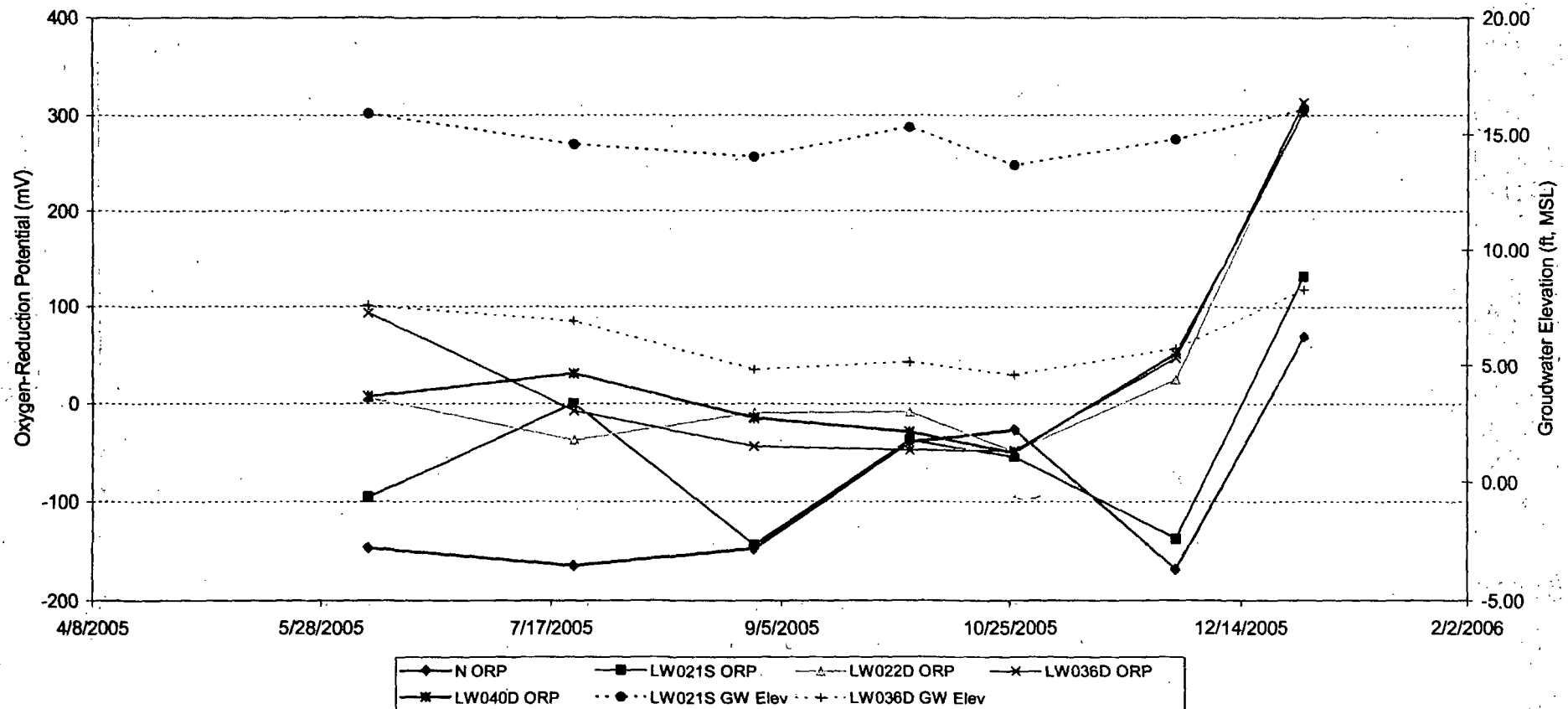


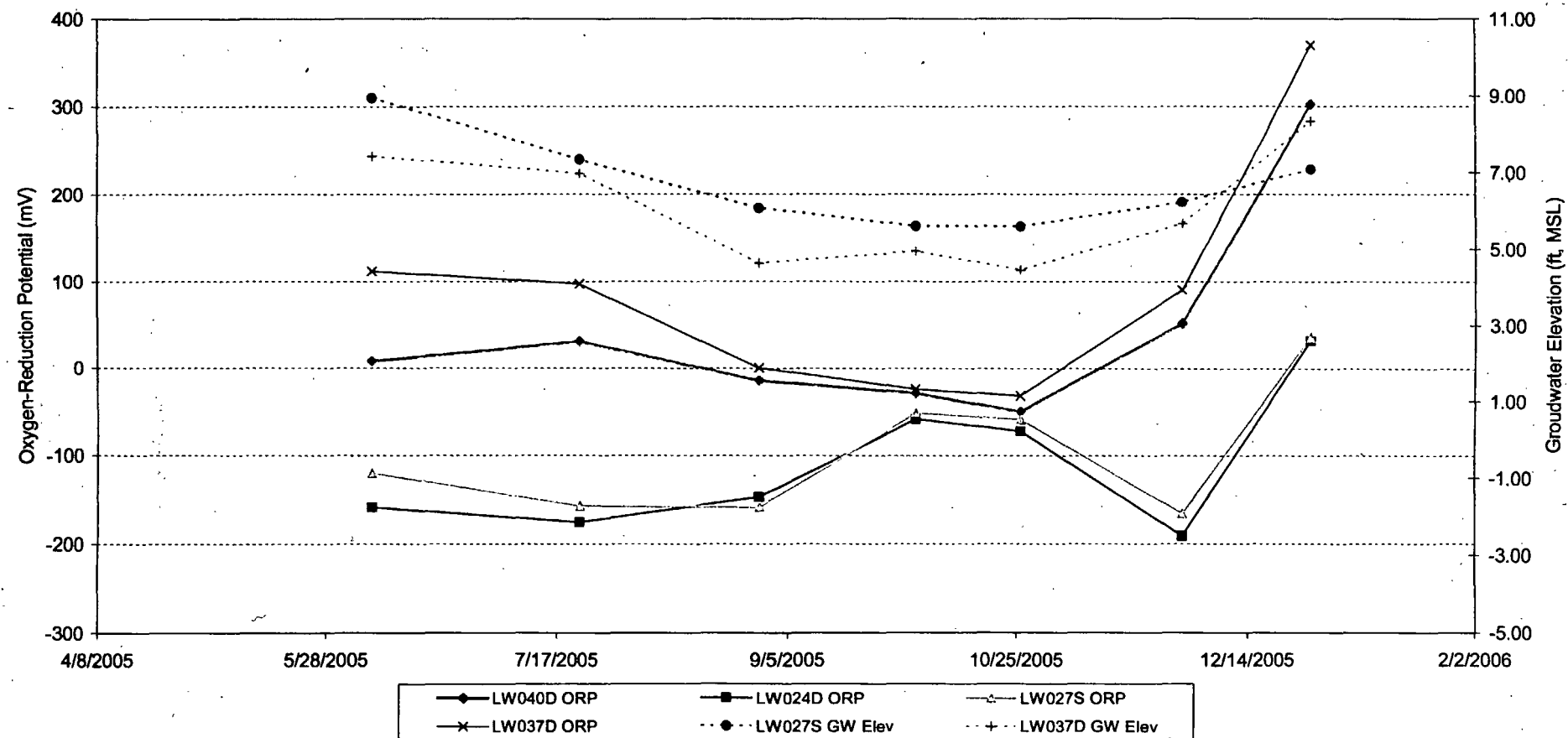


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Nitrate and Sulfate Trends
Flow Path 1

Figure
A-10

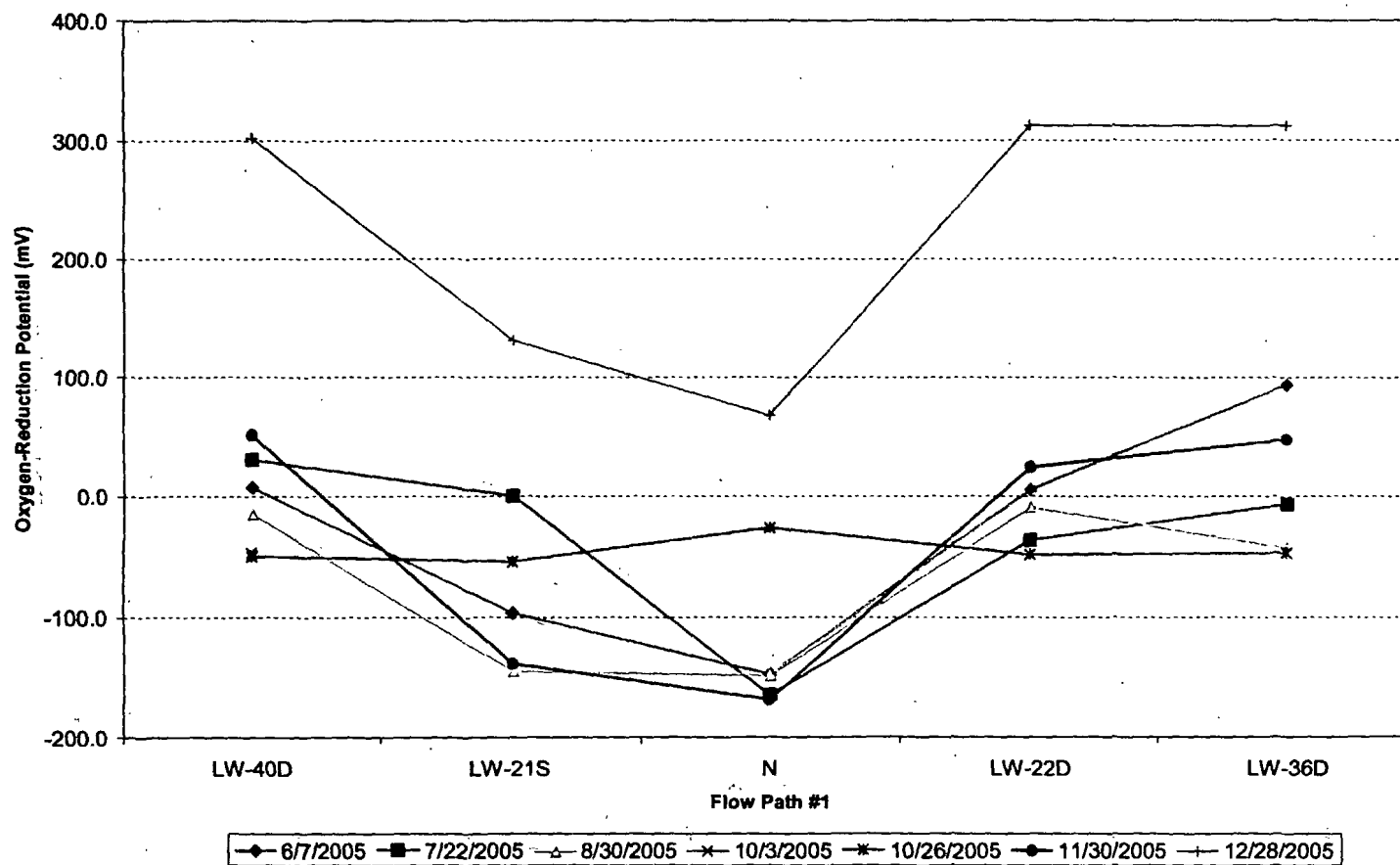


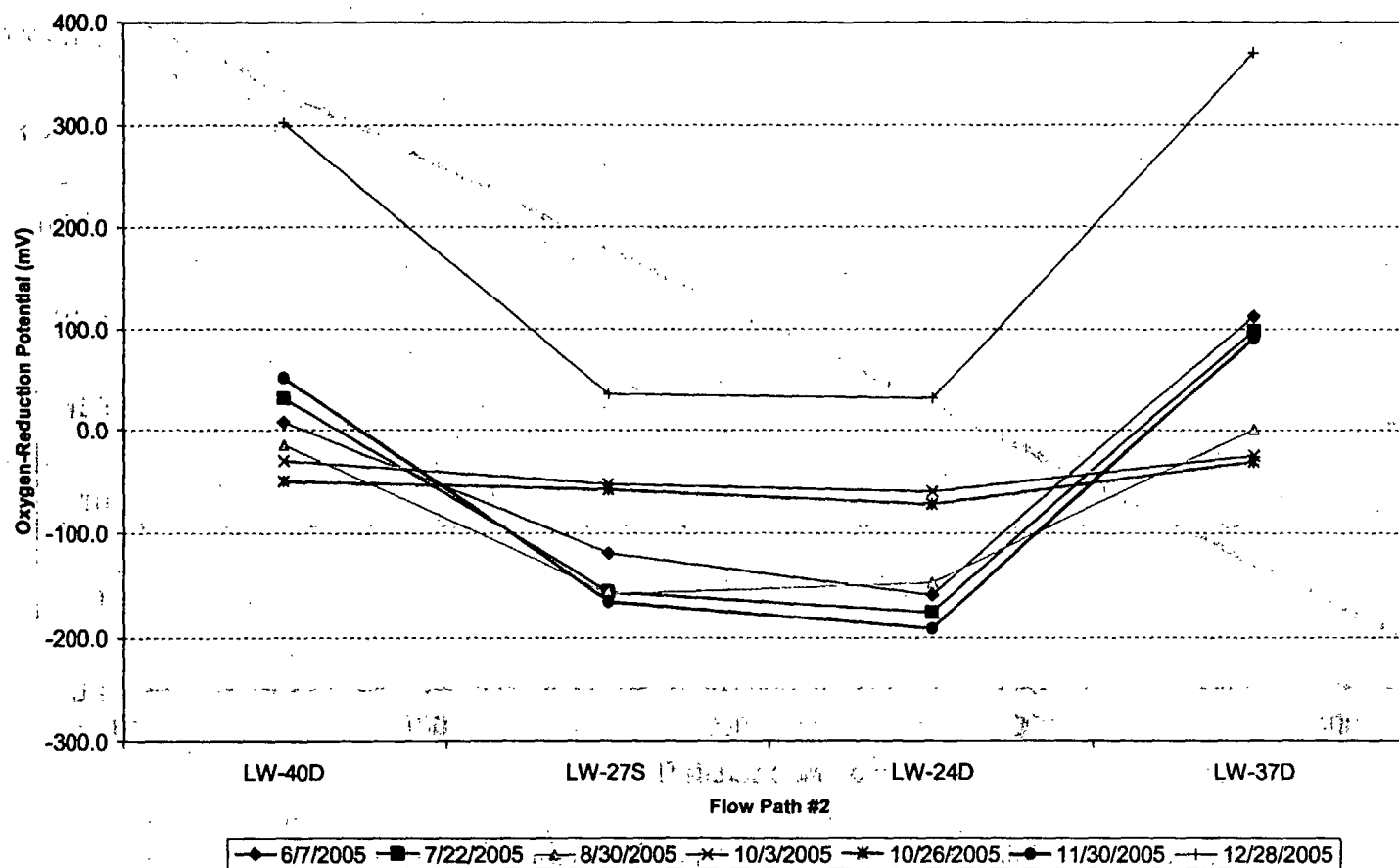


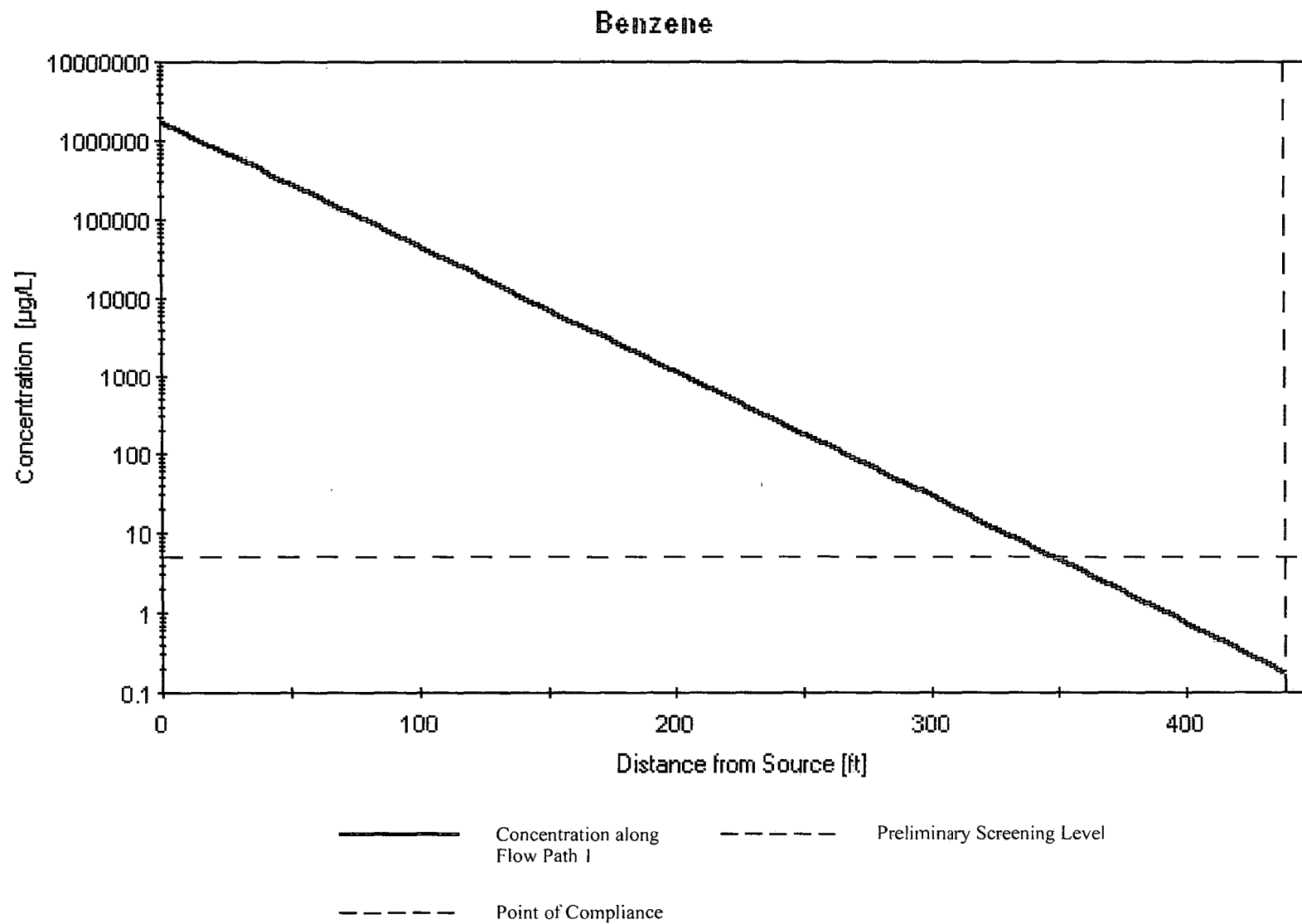
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Portland, Oregon

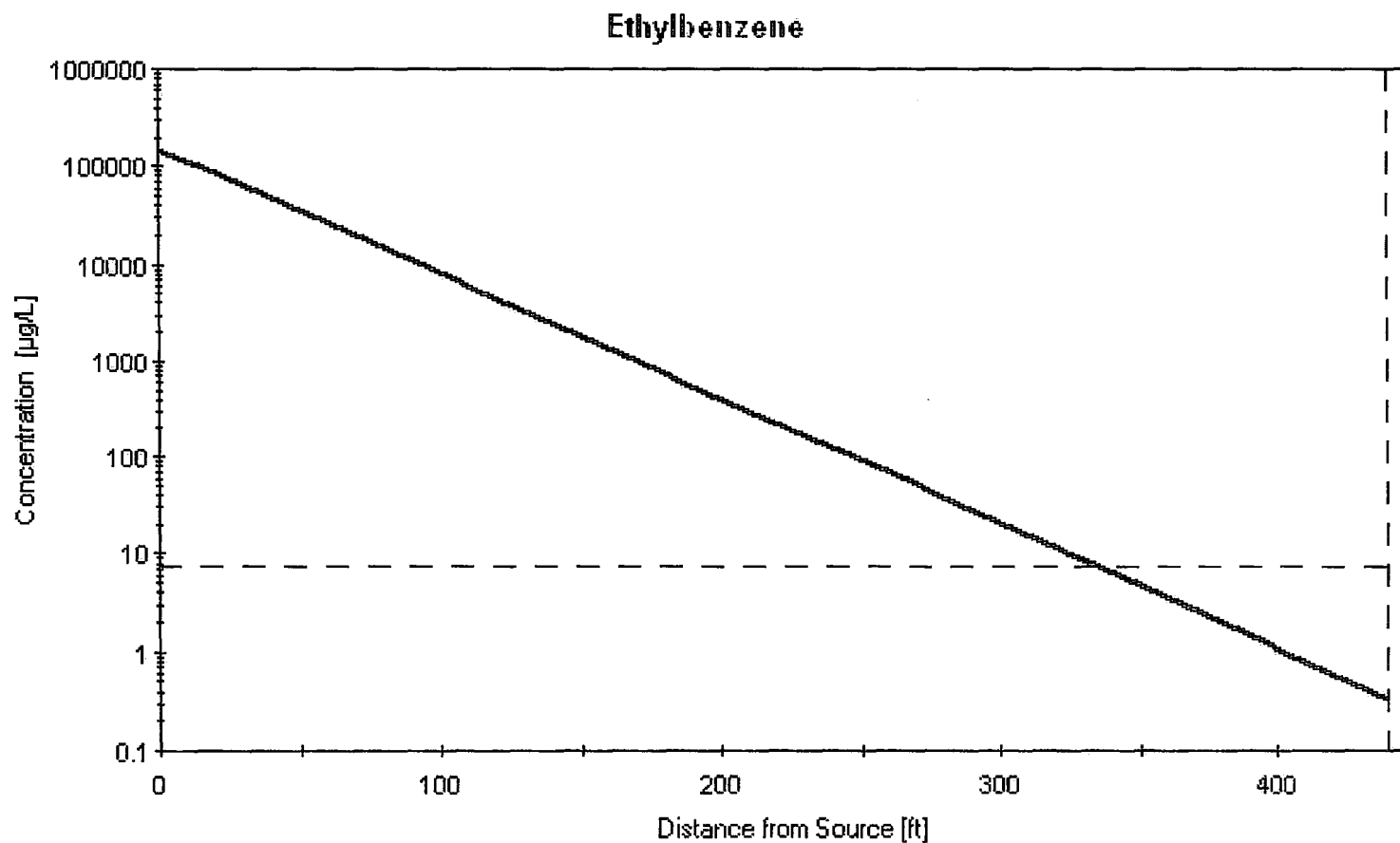
Oxygen-Reduction Potential vs. Time
June-December 2005, Flow Path 2

Figure
A-12









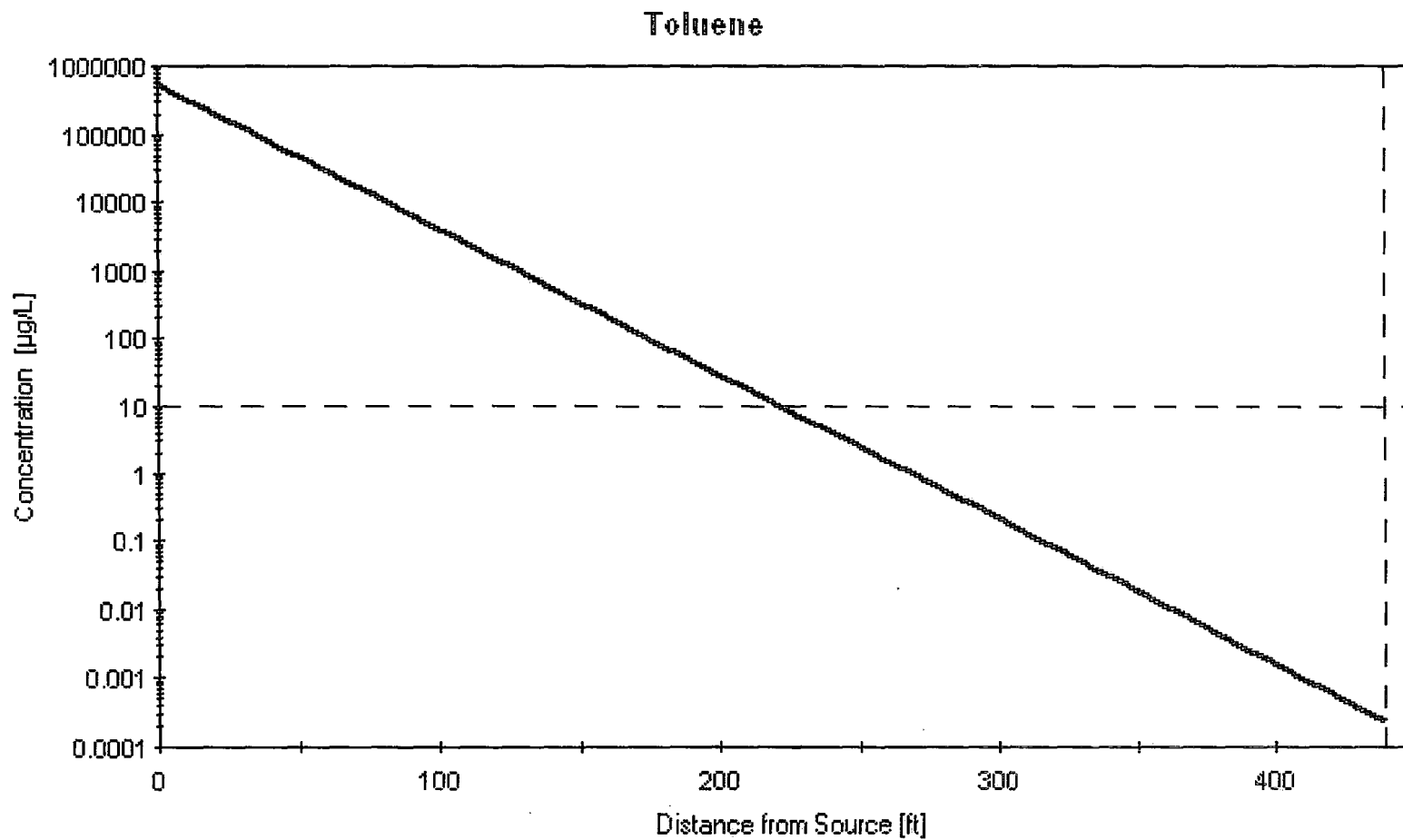
Concentration along Flow Path 1
 Preliminary Screening Level
 Point of Compliance

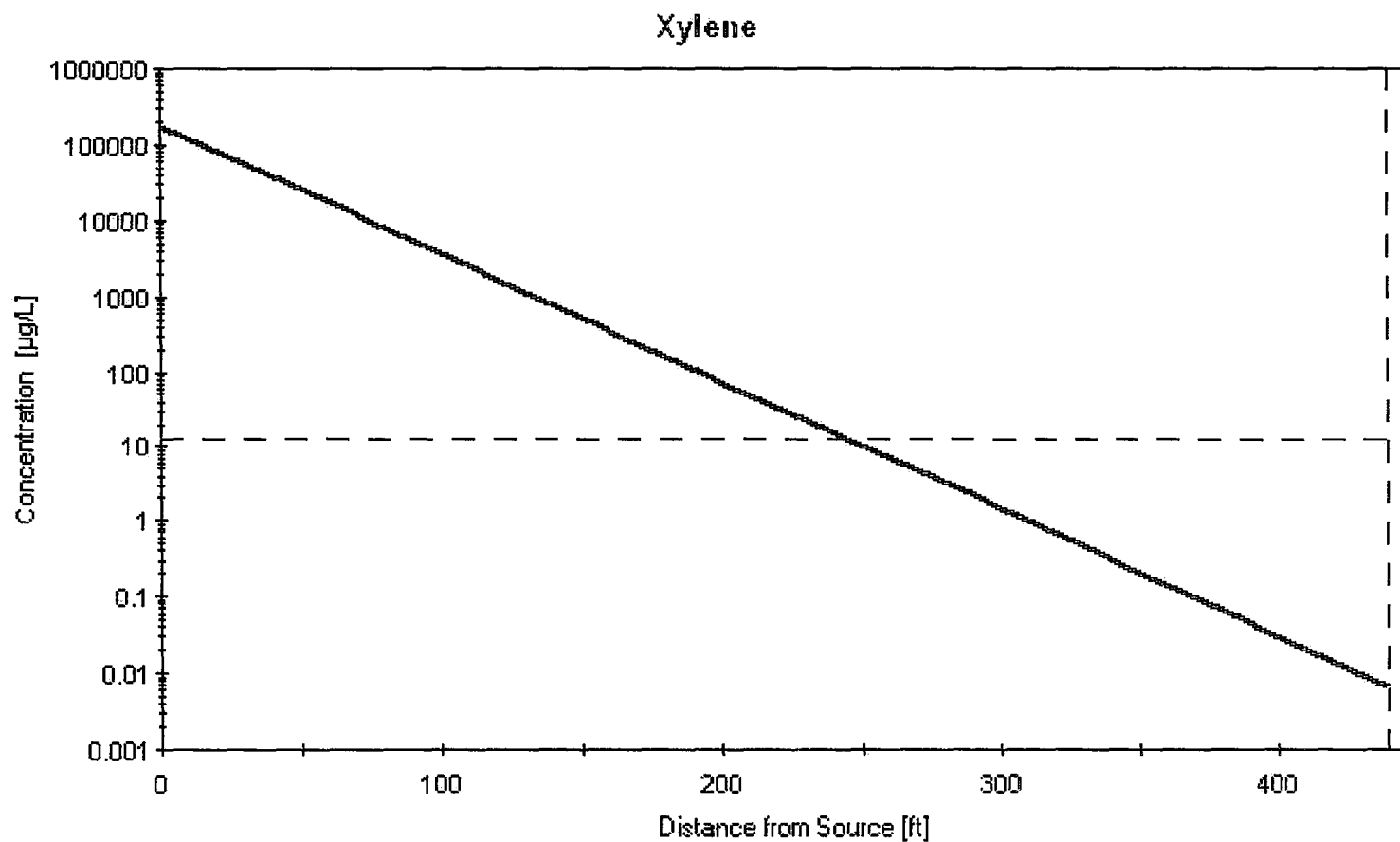


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Portland, Oregon

**Distance of Stabilization – Ethylbenzene
Well LW021S as Source Zone**

Figure
A-16





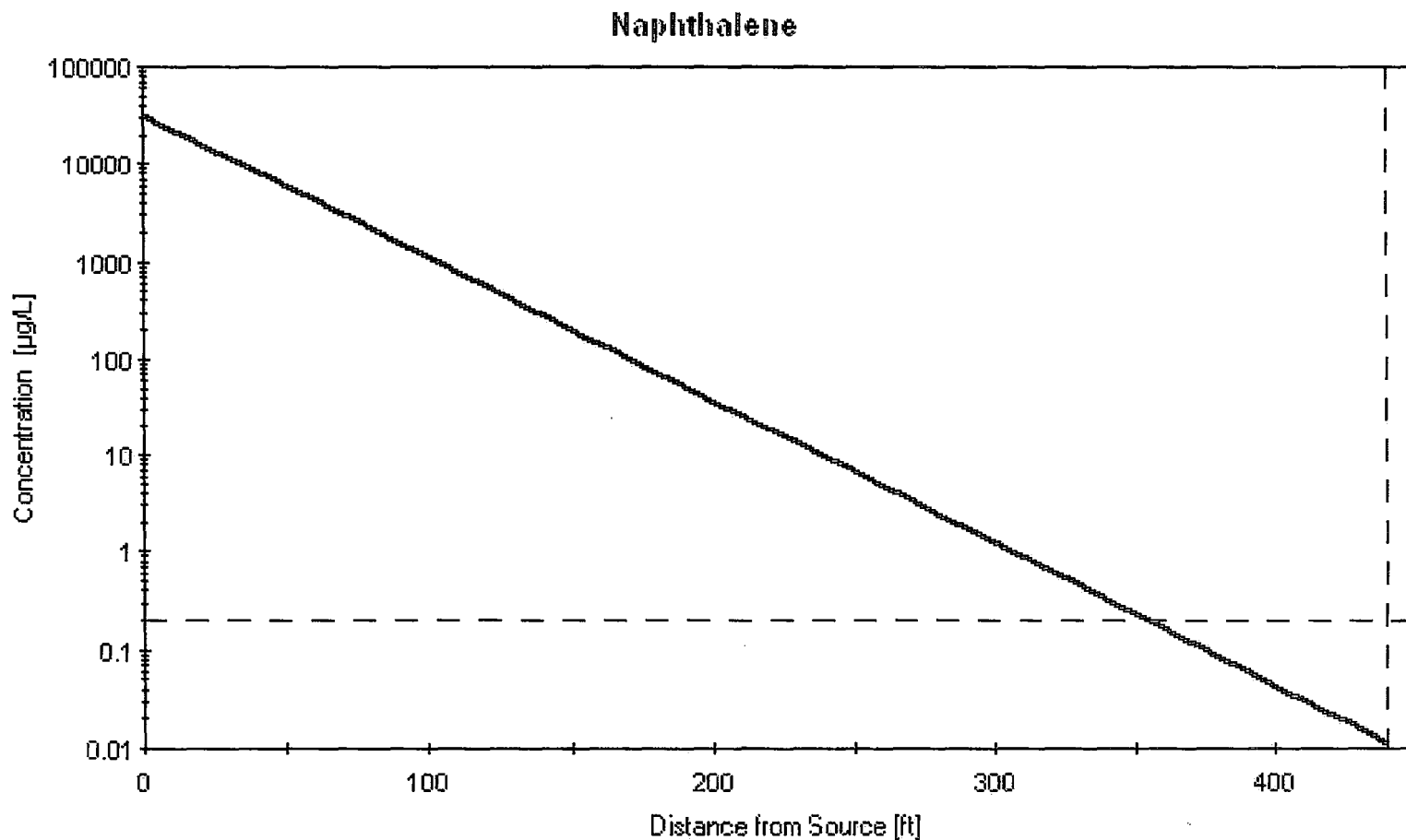
Concentration along Flow Path I
 Preliminary Screening Level
 Point of Compliance



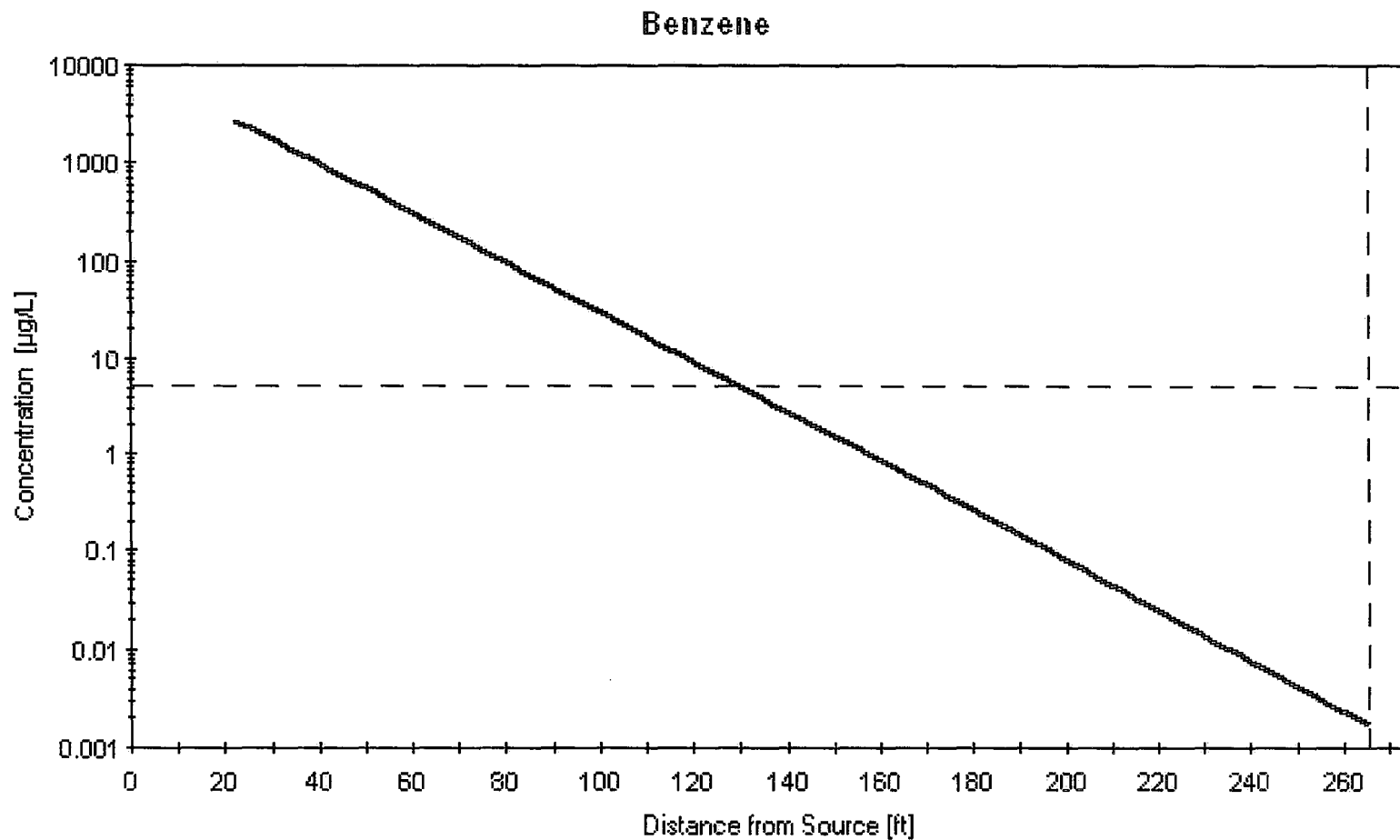
Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

**Distance of Stabilization – Xylene
Well LW021S as Source Zone**

Figure
A-18



Concentration along Flow Path I
 Preliminary Screening Level
 Point of Compliance



Concentration along Flow Path 1
 Preliminary Screening Level

Point of Compliance

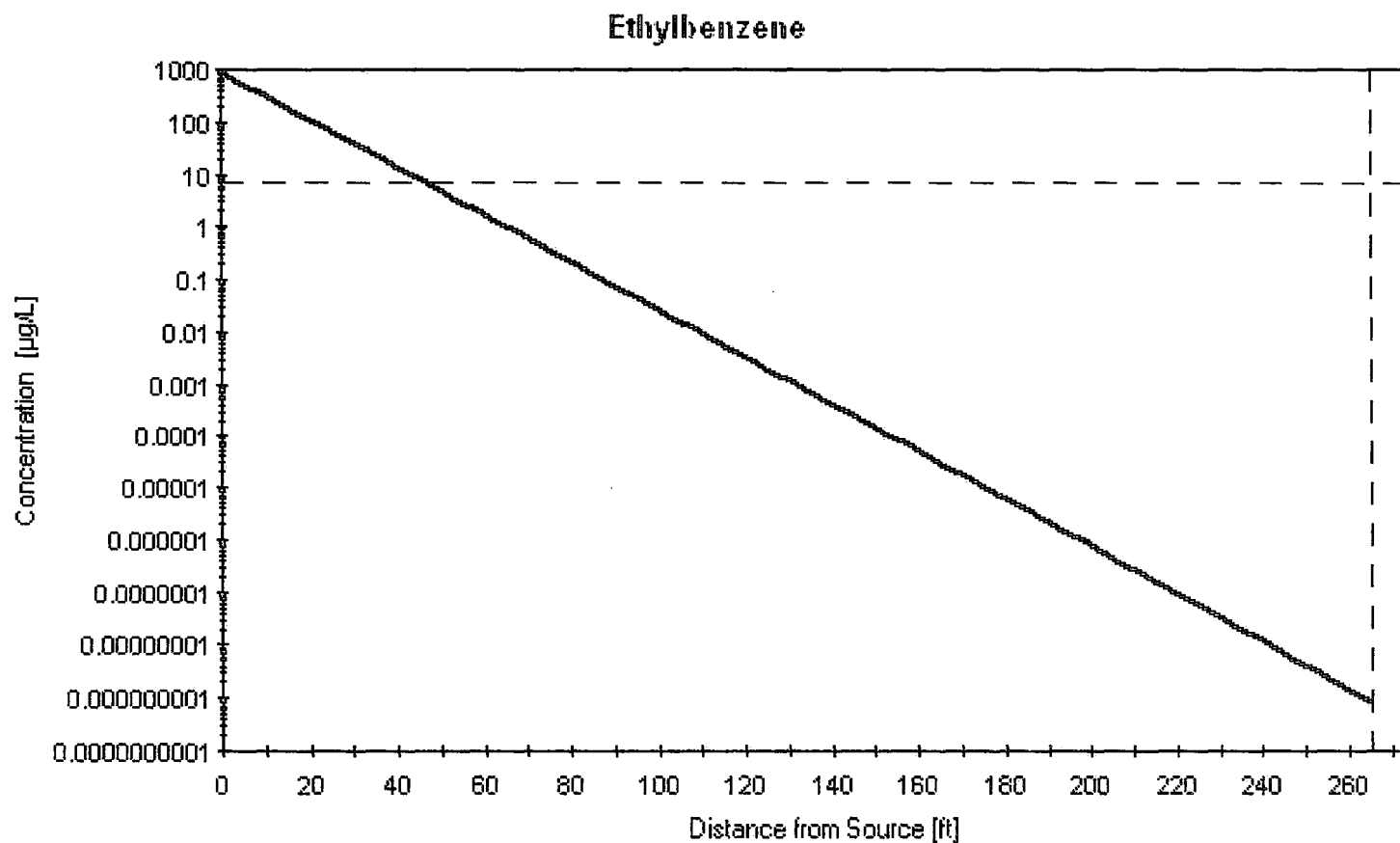


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**Distance of Stabilization – Benzene
Well N as Source Zone**

Figure
A-20



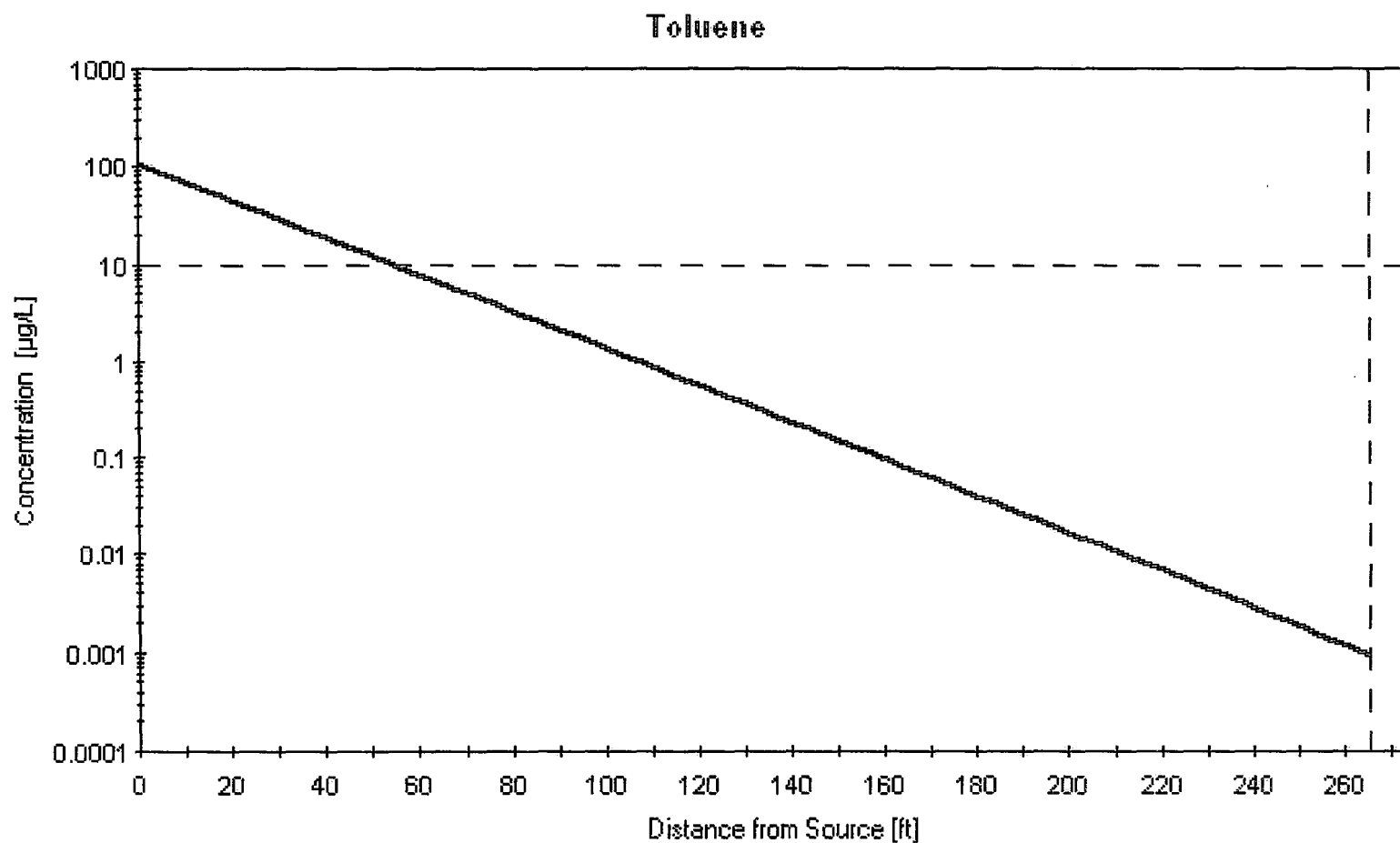
Concentration along Flow Path 1
 Preliminary Screening Level
 Point of Compliance



Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

**Distance of Stabilization –
Ethylbenzene Well N as Source Zone**

Figure
A-21



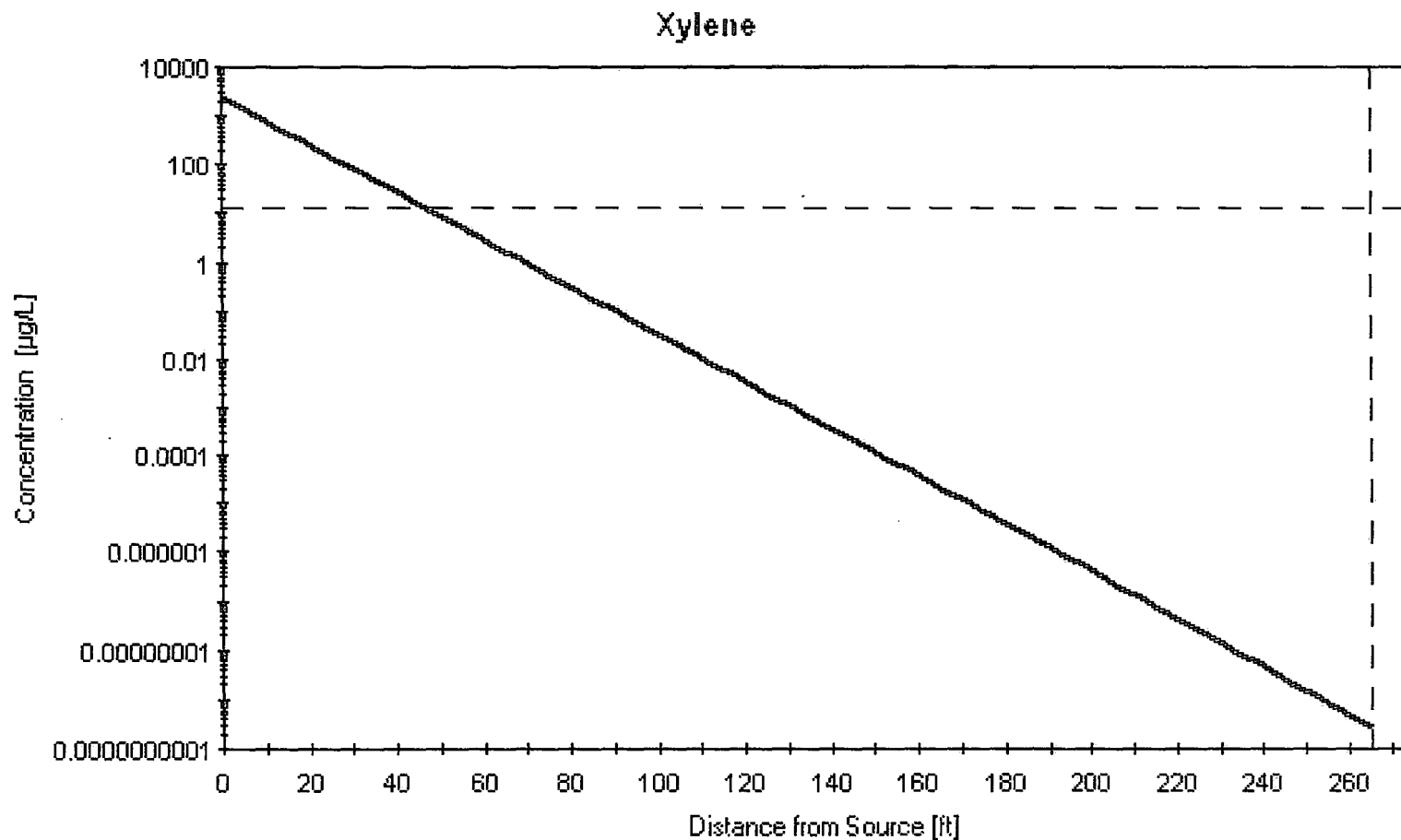
Concentration along Flow Path I
 Preliminary Screening Level
 Point of Compliance



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Time Oil NW Terminal
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**Distance of Stabilization – Toluene
Well N as Source Zone**

Figure
A-22



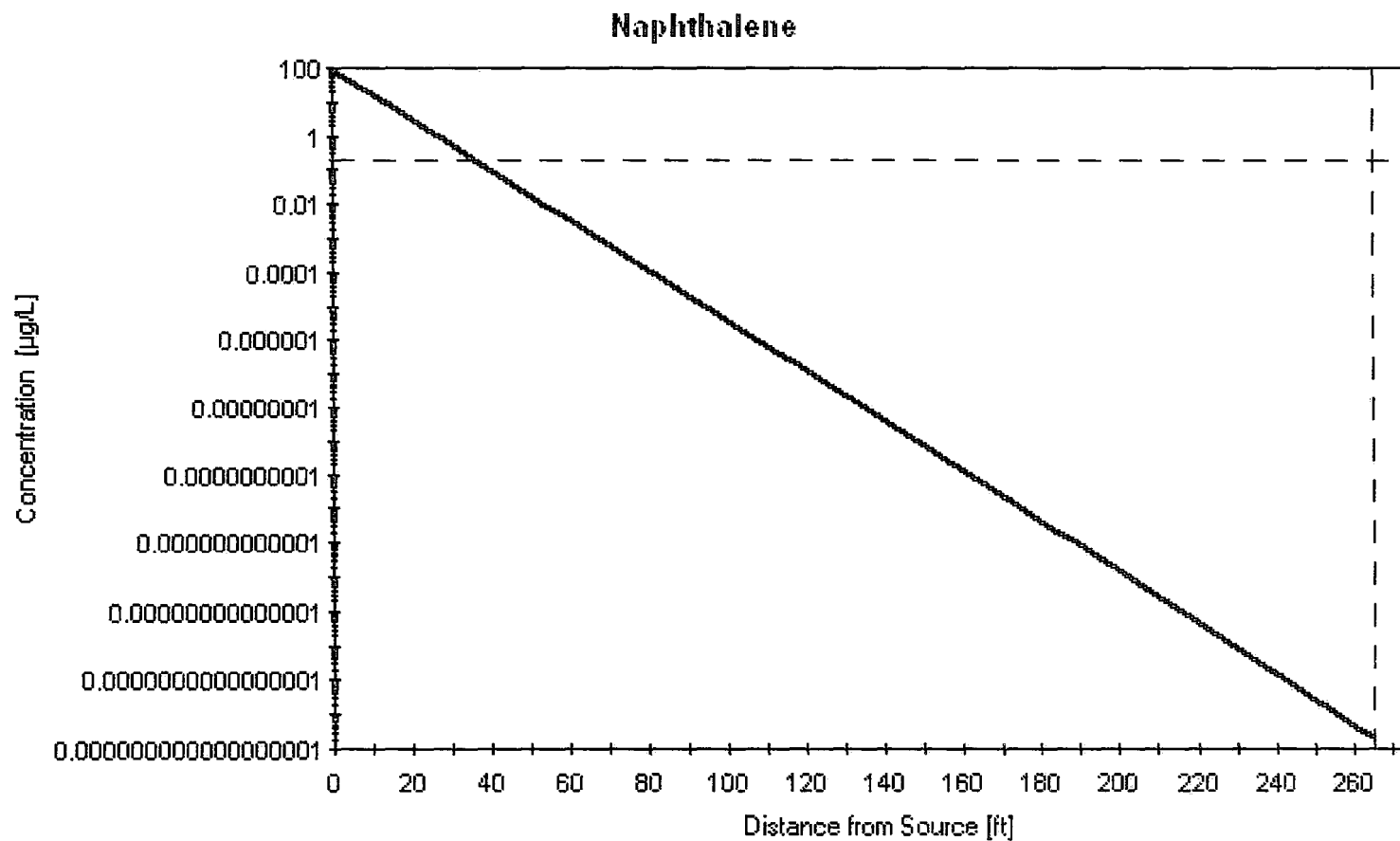
Concentration along Flow Path I
 Preliminary Screening Level
 Point of Compliance



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Portland, Oregon

**Distance of Stabilization – Xylene
Well N as Source Zone**

Figure
A-23



Concentration along Flow Path 1
 Preliminary Screening Level
 Point of Compliance



Source Control Evaluation
Time Oil NW Terminal
Portland, Oregon

**Distance of Stabilization –
Naphthalene Well N as Source Zone**

Figure
A-24

TABLE A-1
MONITORED NATURAL ATTENUATION PARAMETERS
TIME OIL NORTHWEST TERMINAL
PORTLAND, OREGON

Monitoring Well ID	Date	Time	Groundwater Elevation (ft)	pH	Conductivity (mS/cm)	TDS (g/L)	Dissolved Oxygen (mg/L)	Temperature (°C)	Oxygen-Reduction Potential (mV)
MAIN TANK FARM WELLS									
N	6/7/2005	18:13	14.86	6.53	1.967		0.05	13.02	-146.4
	7/22/2005	15:45	14.32	6.49	1.335		1.62	13.77	-164.3
	8/30/2005	18:24	13.76	6.59	1.330	0.864	0.17	13.65	-146.9
	10/3/2005	15:50	18.03	6.84	1.335	0.868	0.11	14.39	-39.1
	10/26/2005	15:58	13.41	6.98	1.298	0.844	0.09	14.58	-26.4
	11/30/2005	15:26	14.11	6.64	0.745	NM	1.04	14.43	-167.9
	12/28/2005	15:27	14.57	6.98	1.501	0.098	0.14	14.66	69.1
P	6/7/2005	18:22	14.33	6.36	2.179		0.11	13.01	-93.0
	7/22/2005	15:33	14.35	6.38	0.811		1.86	13.83	-136.8
	8/30/2005	16:40	13.71	6.44	1.496	0.972	0.08	13.59	-152.0
	10/3/2005	15:07	13.78	6.48	0.839	0.546	0.25	14.00	-21.5
	10/26/2005	15:30	13.04	6.81	0.884	0.575	0.10	14.34	12.0
	11/30/2005	15:22	14.00	6.58	0.998	NM	0.30	14.43	-169.3
	12/28/2005	14:32	14.45	6.66	2.263	0.147	0.38	14.41	82.9
Q	6/7/2005	18:25	14.66	6.66	2.113		0.15	13.37	-149.9
	7/22/2005	15:19	14.15	6.55	1.375		2.79	13.66	-165.7
	8/30/2005	16:30	13.65	6.55	1.408	0.916	0.06	14.24	-167.8
	10/3/2005	15:00	12.96	6.50	1.542	1.004	0.10	14.16	-65.1
	10/26/2005	15:23	13.53	6.67	1.510	0.982	1.08	14.96	-52.1
	11/30/2005	15:16	13.98	6.55	0.797	NM	0.28	14.99	-167.2
	12/28/2005	14:41	14.39	7.02	1.231	0.080	0.27	14.94	-2.8
O	6/7/2005	17:35	8.35	6.43	1.692		0.29	14.42	-50.6
	7/22/2005	15:26	6.85	6.25	0.901		2.58	14.94	-1.8
	8/30/2005	16:20	7.48	6.48	0.803	0.522	0.23	14.05	-10.1
	10/3/2005	14:52	5.43	6.52	0.926	0.602	0.44	14.33	39.9
	10/26/2005	15:12	5.19	6.78	1.047	0.681	0.12	14.48	-49.3
	11/30/2005	15:09	5.88	6.66	0.553	NM	0.60	14.12	-16.8
	12/28/2005	14:13	7.25	6.85	1.124	0.073	0.84	14.58	119.6
R	6/7/2005	17:39	8.36	6.19	0.718		0.33	14.45	7.2
	7/22/2005	15:22	6.82	6.16	0.984		2.46	14.81	-47.9
	8/30/2005	16:50	5.45	6.67	1.676	1.089	0.31	14.32	-162.6
	10/3/2005	15:13	5.22	6.61	1.529	0.994	0.14	14.19	-88.4
	10/26/2005	15:44	5.05	6.91	1.484	0.965	0.11	14.38	-68.7
	11/30/2005	15:00	5.85	6.59	0.802	NM	0.38	14.41	-151.5
	12/28/2005	14:51	7.25	7.19	0.861	0.056	2.91	14.72	-6.1
LW-19S	6/7/2005	15:40	12.90	6.63	2.363		0.05	13.42	-145.9
	7/22/2005	12:55	12.27	6.62	1.579		0.69	13.93	-158.3
	8/30/2005	17:30	11.64	6.63	1.607	1.044	0.10	13.96	-159.9
	10/3/2005	14:05	11.92	6.41	1.632	1.061	0.08	14.76	-86.8
	10/26/2005	14:44	11.18	6.54	1.668	1.097	0.10	14.66	-50.3
	11/30/2005	16:13	11.64	6.71	1.041	NM	0.24	14.43	-172.7
	12/28/2005	13:41	12.42	6.66	2.020	0.131	0.48	14.38	97.4
LW-20S	6/7/2005	15:33	15.81	6.36	1.212		0.19	13.60	-137.2
	7/22/2005	16:36	15.16	6.38	1.248		2.10	15.14	-137.3
	8/30/2005	14:35	14.67	6.57	1.278	0.831	0.10	15.06	-164.2
	10/3/2005	14:20	15.67	6.41	1.111	0.723	0.09	16.08	-78.5
	10/26/2005	15:02	14.65	6.57	1.281	0.832	0.09	16.56	-62.4
	11/30/2005	16:24	15.41	6.61	0.513	NM	0.32	15.60	-169.3
	12/28/2005	14:01	15.99	6.89	0.871	0.057	0.37	14.43	28.5
LW-20D	6/7/2005	15:31	7.81	6.97	1.128		0.92	14.29	-174.9
	7/22/2005	16:41	6.77	6.70	0.683		4.20	14.57	-144.1
	8/30/2005	14:30	4.58	6.90	0.705	0.458	0.52	14.91	-141.3
	10/3/2005	14:25	4.76	6.65	0.770	0.502	0.19	14.18	84.3
	10/26/2005	14:54	5.29	7.26	0.707	0.459	0.10	14.21	-72.6
	11/30/2005	16:20	6.61	6.98	0.453	NM	0.84	14.43	161.7
	12/28/2005	13:52	8.65	7.67	0.867	0.056	0.80	14.97	32.6

TABLE A-1
MONITORED NATURAL ATTENUATION PARAMETERS
TIME OIL NORTHWEST TERMINAL
PORTLAND, OREGON

Monitoring Well ID	Date	Time	Groundwater Elevation (ft)	pH	Conductivity (mS/cm)	TDS (g/L)	Dissolved Oxygen (mg/L)	Temperature (°C)	Oxygen- Reduction Potential (mV)
LW-21S	6/7/2005	18:31	15.87	6.22	0.677		0.18	13.73	-96.0
	7/22/2005	16:58	14.55	6.28	0.958		2.08	14.84	NM
	8/30/2005	17:15	14.01	6.39	1.005	0.653	0.09	14.91	-143.6
	10/3/2005	15:40	15.29	6.38	0.652	0.423	0.11	17.83	-37.6
	10/26/2005	16:42	13.65	6.92	0.875	0.567	0.08	15.83	-54.7
	11/30/2005	15:53	14.75	6.52	0.408	NM	0.21	14.87	-137.8
	12/28/2005	16:00	16.07	7.72	0.442	0.028	0.37	12.64	131.9
LW-22D	6/7/2005	16:31	8.20	6.84	0.835		1.08	14.43	5.8
	7/22/2005	13:16	6.75	6.29	0.780		0.80	14.43	-37.0
	8/30/2005	16:00	5.31	6.30	0.692	0.450	0.14	14.18	-8.4
	10/3/2005	10:59	5.20	6.55	0.628	0.408	1.32	14.42	-8.0
	10/26/2005	10:55	5.03	6.55	0.757	0.492	0.27	14.45	-48.6
	11/30/2005	14:39	5.84	6.74	0.359	NM	0.34	14.59	24.8
	12/28/2005	12:30	7.31	6.16	1.110	0.033	0.19	14.60	313.7
LW-23D	6/7/2005	16:37	8.14	6.92	1.806		1.00	13.70	-100.4
	7/22/2005	13:13	6.76	6.88	1.628		1.09	14.24	-169.6
	8/30/2005	16:12	5.29	6.92	1.586	1.031	0.18	13.56	-161.6
	10/3/2005	11:04	5.11	6.55	1.330	0.864	0.11	14.00	-78.7
	10/26/2005	10:45	5.04	6.44	1.407	0.915	0.15	14.10	-45.2
	11/30/2005	14:28	5.79	6.84	0.825	NM	0.46	14.01	-190.6
	12/28/2005	12:42	7.27	6.77	1.624	0.105	0.37	14.19	200.7
LW-24D	6/7/2005	16:45	8.22	6.68	1.823		0.39	15.25	-159.3
	7/22/2005	13:20	6.81	6.62	1.273		0.68	14.97	-176.4
	8/30/2005	17:45	5.41	6.49	1.295	0.842	0.36	14.80	-147.4
	10/3/2005	10:25	5.26	6.49	1.250	0.813	0.13	15.18	-58.6
	10/26/2005	11:08	5.30	6.51	1.231	0.826	0.12	15.10	-72.4
	11/30/2005	14:10	5.84	6.70	0.789	NM	0.38	15.01	-191.3
	12/28/2005	12:55	7.17	7.12	1.543	0.100	0.26	15.24	32.1
LW-25D	6/7/2005	16:50	8.13	6.45	1.302		1.21	15.36	-112.0
	7/22/2005	13:41	6.82	6.47	1.037		0.78	15.72	-161.6
	8/30/2005	17:53	5.40	6.47	1.170	0.761	0.09	15.36	-168.2
	10/3/2005	10:30	5.05	6.30	1.127	0.733	0.23	15.30	-96.8
	10/26/2005	11:20	5.26	6.38	1.116	0.768	0.10	15.18	-81.9
	11/30/2005	13:59	5.83	6.52	0.678	NM	0.52	15.08	-178.3
	12/28/2005	13:08	7.26	6.88	1.268	0.082	0.40	15.30	23.8
LW-26D	6/7/2005	17:47	7.25	6.92	1.299		0.85	13.67	-90.0
	7/22/2005	15:59	6.56	6.63	0.936		3.90	14.31	-121.1
	8/30/2005	18:16	4.97	6.65	0.916	0.593	0.46	13.54	-161.3
	10/3/2005	15:57	4.74	6.80	1.007	0.657	0.09	13.75	-56.8
	10/26/2005	16:06	4.96	6.98	0.969	0.630	0.09	13.87	-73.8
	11/30/2005	15:32	6.46	6.97	0.554	NM	0.87	14.04	-128.0
	12/28/2005	15:15	9.08	7.54	1.115	0.025	0.83	14.90	62.9
LW-27S	6/7/2005	17:59	8.94	6.37	1.445		0.08	12.66	-119.7
	7/22/2005	16:09	7.34	6.39	1.135		1.50	14.08	-156.9
	8/30/2005	18:30	6.06	6.52	1.376	0.895	0.15	13.60	-158.2
	10/3/2005	16:14	5.59	6.40	1.305	0.848	0.14	14.22	-51.1
	10/26/2005	16:26	5.58	6.57	1.050	0.683	0.07	14.90	-58.4
	11/30/2005	15:46	6.21	6.50	0.542	NM	0.22	15.81	-165.5
	12/28/2005	15:48	7.08	6.66	0.859	0.055	0.14	14.95	35.9
LW-27D	6/7/2005	17:56	7.16	6.90	1.344		0.25	14.44	-134.9
	7/22/2005	16:02	6.50	6.92	0.923		2.65	15.65	-121.4
	8/30/2005	18:07	4.89	6.66	0.907	0.590	1.75	13.98	-116.4
	10/3/2005	16:10	12.59	6.70	0.926	0.602	0.10	14.29	-55.1
	10/26/2005	16:21	4.83	7.14	0.932	0.606	0.09	14.33	-69.4
	11/30/2005	15:40	6.49	6.92	0.541	NM	0.61	14.62	-106.5
	12/28/2005	15:40	9.20	7.26	1.091	0.070	2.14	15.29	42.8

TABLE A-1
MONITORED NATURAL ATTENUATION PARAMETERS
TIME OIL NORTHWEST TERMINAL
PORTLAND, OREGON

Monitoring Well ID	Date	Time	Groundwater Elevation (ft)	pH	Conductivity (mS/cm)	TDS (g/L)	Dissolved Oxygen (mg/L)	Temperature (°C)	Oxygen-Reduction Potential (mV)
LW-35D	6/7/2005	16:25	8.39	6.63	1.253		0.85	13.70	-23.0
	7/22/2005	12:46	6.76	6.34	1.202		3.16	13.93	-8.5
	8/30/2005	15:11	6.47	6.12	1.197	0.361	0.27	14.89	-10.2
	10/3/2005	10:45	5.22	6.35	1.396	0.907	0.17	13.64	-39.2
	10/26/2005	9:37	5.07	5.91	3.070	1.996	0.41	13.64	-61.6
	11/30/2005	14:51	5.87	6.61	0.962	NM	0.36	13.51	-2.5
	12/28/2005	11:24	7.16	6.47	1.866	0.121	0.46	13.69	326.9
LW-36D	6/7/2005	17:05	7.57	7.52	0.282		2.04	15.28	93.9
	7/22/2005	14:21	6.90	6.49	0.556		2.15	15.91	-6.7
	8/30/2005	15:45	4.83	6.54	0.465	0.303	0.13	17.22	-42.7
	10/3/2005	10:05	5.15	6.55	1.144	0.743	0.25	15.98	-46.8
	10/26/2005	10:30	4.60	6.35	1.021	0.664	0.25	16.31	-47.3
	11/30/2005	13:12	5.73	6.84	0.349	NM	1.06	14.83	47.9
	12/28/2005	12:14	8.29	6.32	0.306	0.020	4.15	11.37	312.9
LW-37D	6/7/2005	16:59	7.44	7.32	0.456		5.17	14.41	112.4
	7/22/2005	14:51	6.99	6.85	0.151		5.11	16.73	97.9
	8/30/2005	15:35	4.64	6.55	0.323	0.209	1.02	16.44	0.8
	10/3/2005	9:59	4.96	6.78	0.266	0.175	1.10	15.62	-23.5
	10/26/2005	10:19	4.47	6.50	0.212	0.137	0.55	15.53	-31.2
	11/30/2005	13:23	5.67	7.01	0.080	NM	1.92	13.62	91.2
	12/28/2005	12:01	8.34	6.50	0.143	0.008	1.16	10.04	370.1
LW-38D	6/7/2005	17:15	7.00	7.24	0.244		2.74	15.93	50.0
	7/22/2005	14:06	6.72	6.35	0.151		3.20	18.97	311.8
	8/30/2005	15:25	4.43	6.53	0.225	0.164	0.46	18.26	-52.1
	10/3/2005	9:50	4.91	6.37	0.396	0.259	0.60	17.30	-32.0
	10/26/2005	10:15	4.03	6.65	0.251	0.161	1.10	17.11	-9.9
	11/30/2005	13:34	5.76	6.85	0.120	NM	1.65	13.94	24.4
	12/28/2005	11:53	8.48	6.65	0.197	0.013	2.00	10.34	289.7
LW-39D	6/7/2005	17:20	7.35	7.44	0.208		1.00	15.21	63.8
	7/22/2005	14:02	6.89	6.90	0.168		2.59	19.14	-51.0
	8/30/2005	15:15	4.54	6.85	0.258	0.166	0.24	17.89	-77.2
	10/3/2005	9:44	4.93	6.65	0.654	0.425	1.95	15.89	-102.0
	10/26/2005	10:03	3.40	6.72	0.220	0.143	0.17	15.72	-56.6
	11/30/2005	13:45	5.84	6.78	0.119	NM	0.23	13.62	-97.2
	12/28/2005	11:45	8.35	6.94	0.293	0.019	1.00	10.59	268.1
LW-40S	6/7/2005	16:04	13.86	6.30	0.611		0.53	13.48	16.4
	7/22/2005	12:16	13.53	5.68	0.260		1.67	14.09	47.1
	8/30/2005	15:08	13.27	6.37	0.354	0.198	0.65	14.09	39.7
	10/3/2005	14:32	13.87	6.90	0.275	0.181	1.14	13.80	1.6
	10/26/2005	9:29	13.40	5.72	0.361	0.234	2.12	13.93	15.7
	11/30/2005	11:58	13.35	5.64	0.551	NM	4.19	14.05	93.4
	12/28/2005	11:14	13.90	6.07	0.571	0.037	1.97	14.53	329.9
LW-40D	6/7/2005	15:56	7.80	6.91	0.421		0.26	13.37	7.4
	7/22/2005	12:20	7.19	6.16	0.349		3.96	13.41	30.7
	8/30/2005	15:00	4.44	6.90	0.367	0.239	1.34	13.80	-14.4
	10/3/2005	14:41	4.97	6.74	0.286	0.186	1.21	13.17	-28.8
	10/26/2005	9:19	4.17	7.01	0.258	0.198	0.41	13.39	-50.2
	11/30/2005	11:54	5.64	6.39	0.199	NM	1.35	12.94	51.8
	12/28/2005	11:05	8.13	7.24	0.365	0.024	1.10	13.38	302.9
LW-45D	6/7/2005	16:15	8.59	6.12	0.772		0.63	13.99	5.6
	7/22/2005	12:39	6.88	6.29	1.093		0.72	14.20	-46.9
	8/30/2005	17:00	5.74	6.58	1.563	1.017	0.32	13.23	-117.1
	10/3/2005	15:25	5.40	6.52	1.677	1.090	0.13	13.84	-63.5
	10/26/2005	11:38	5.28	6.21	1.703	1.107	0.17	13.82	-46.8
	11/30/2005	12:15	5.89	6.44	0.877	NM	0.48	13.62	-150.3
	12/28/2005	15:00	7.11	6.80	2.153	0.140	0.22	14.06	50.4

TABLE A-1
MONITORED NATURAL ATTENUATION PARAMETERS
TIME OIL NORTHWEST TERMINAL
PORTLAND, OREGON

Monitoring Well ID	Date	Time	Groundwater Elevation (ft)	pH	Conductivity (mS/cm)	TDS (g/L)	Dissolved Oxygen (mg/L)	Temperature (°C)	Oxygen-Reduction Potential (mV)
BELL TERMINAL WELLS									
LW-28S	6/7/2005	12:15	16.18	5.95	0.388		3.81	12.57	381.7
	7/22/2005	10:28	15.47	6.10	0.207		2.09	13.34	-10.7
	8/30/2005	11:52	14.76	8.34	0.204	0.003	3.01	15.73	249.3
	10/3/2005	12:00	14.98	7.34	0.252	0.163	2.09	14.75	14.3
	10/26/2005	12:37	Dry	NM	NM	NM	NM	NM	NM
	11/30/2005	9:18	15.54	6.25	0.203	NM	3.05	14.07	-48.7
	12/28/2005	8:15	16.34	7.80	0.326	0.020	5.98	14.33	234.1
LW-29S	6/7/2005	14:39	13.73	6.87	0.561		0.81	13.25	-140.9
	7/22/2005	11:15	13.14	6.58	0.493		1.41	13.93	-122.8
	8/30/2005	13:10	12.74	6.99	0.429	0.279	0.09	13.70	-148.6
	10/3/2005	13:06	19.09	6.94	0.361	0.235	0.14	14.08	-61.1
	10/26/2005	13:03	12.51	6.81	0.510	0.331	0.11	14.32	-33.7
	11/30/2005	9:45	13.07	6.84	0.269	NM	0.45	14.47	-153.4
	12/28/2005	8:45	13.58	6.80	0.279	0.019	2.96	14.51	236.1
LW-29D	6/7/2005	14:23	7.70	7.24	1.661		0.35	13.65	-193.2
	7/22/2005	11:17	7.33	7.04	1.118		1.60	13.72	-161.3
	8/30/2005	13:04	4.54	7.20	1.104	0.718	0.12	13.35	-192.6
	10/3/2005	13:09	5.00	6.93	1.074	0.698	0.13	13.49	-102.8
	10/26/2005	12:57	4.60	6.75	1.056	0.686	0.14	13.57	-32.4
	11/30/2005	9:42	5.90	7.26	0.643	NM	2.04	13.47	-180.9
	12/28/2005	8:40	8.04	7.55	1.311	0.085	0.51	13.90	120.1
LW-30S	6/7/2005	14:27	13.37	6.58	0.746		0.13	13.31	-151.1
	7/22/2005	11:27	12.82	6.68	0.726		0.51	13.63	-159.6
	8/30/2005	13:21	12.43	6.56	0.485	0.315	0.07	14.04	-136.2
	10/3/2005	13:22	12.81	6.78	0.547	0.356	0.05	14.32	-72.7
	10/26/2005	13:19	12.18	6.77	0.509	0.330	0.12	14.74	-46.1
	11/30/2005	10:04	12.78	6.61	0.317	NM	1.17	14.69	-131.1
	12/28/2005	9:13	13.25	6.39	0.664	0.043	0.66	14.80	8.0
LW-30D	6/7/2005	14:32	7.36	6.62	1.683		0.35	13.72	-142.1
	7/22/2005	11:29	7.25	6.55	1.091		0.60	13.78	-146.6
	8/30/2005	13:15	4.06	6.62	1.086	0.706	0.09	13.52	-145.7
	10/3/2005	13:25	4.73	6.66	1.016	0.661	0.24	13.62	-70.3
	10/26/2005	13:14	4.59	6.68	1.028	0.668	0.17	13.65	-36.3
	11/30/2005	10:02	5.66	6.73	0.657	NM	1.70	13.47	-146.4
	12/28/2005	9:00	8.04	6.64	1.355	0.088	2.96	14.21	24.1
LW-31S	6/7/2005	14:00	13.81	6.35	0.372		1.98	13.46	-41.6
	7/22/2005	9:50	13.18	6.41	0.285		1.04	13.67	-65.1
	8/30/2005	12:32	12.69	6.78	0.224	0.146	0.33	13.81	-89.0
	10/3/2005	12:43	12.66	6.70	0.338	0.220	0.08	14.52	-41.4
	10/26/2005	14:09	12.30	6.79	0.212	0.138	0.12	15.06	-42.5
	11/30/2005	11:14	13.05	6.40	0.135	NM	3.04	15.17	16.2
	12/28/2005	10:20	13.64	7.13	0.313	0.020	3.61	15.36	290.9
LW-32S	6/7/2005	13:33	15.21	6.26	1.125		0.09	12.53	-85.0
	7/22/2005	9:22	14.64	6.58	1.121		0.63	13.58	-163.0
	8/30/2005	12:58	13.96	6.64	0.799	0.518	0.08	13.46	-169.1
	10/3/2005	12:48	14.03	6.45	0.832	0.553	0.08	14.45	-66.8
	10/26/2005	14:29	13.62	6.43	0.791	0.514	0.10	15.13	-54.6
	11/30/2005	11:29	14.47	6.24	0.355	NM	0.66	14.51	-115.8
	12/28/2005	10:50	15.22	6.49	0.335	0.021	3.83	14.17	294.3
LW-32D	6/7/2005	13:43	8.25	6.85	1.501		0.08	13.57	-105.1
	7/22/2005	9:20	8.20	6.88	0.982		1.64	13.52	-69.9
	8/30/2005	12:43	5.56	6.94	1.111	0.722	0.15	13.35	-171.4
	10/3/2005	12:05	6.08	6.59	1.106	0.719	0.15	13.59	-92.0
	10/26/2005	14:24	5.40	6.56	1.114	0.724	0.12	13.72	-49.9
	11/30/2005	11:27	6.53	7.00	0.676	NM	2.15	13.80	-160.7
	12/28/2005	10:38	9.63	6.86	1.347	0.087	0.44	14.51	202.7

TABLE A-1
MONITORED NATURAL ATTENUATION PARAMETERS
TIME OIL NORTHWEST TERMINAL
PORTLAND, OREGON

Monitoring Well ID	Date	Time	Groundwater Elevation (ft)	pH	Conductivity (mS/cm)	TDS (g/L)	Dissolved Oxygen (mg/L)	Temperature (°C)	Oxygen-Reduction Potential (mV)
LW-33S	6/7/2005	12:00	14.45	5.91	0.463		1.34	13.73	113.6
	7/22/2005	9:41	13.80	6.80	0.344		1.42	14.82	-70.0
	8/30/2005	11:22	13.11	6.80	0.329	0.213	0.34	14.67	-77.9
	10/3/2005	12:31	13.45	6.63	0.337	0.218	0.12	15.75	-45.6
	10/26/2005	14:01	12.79	6.92	0.347	0.224	0.71	15.98	10.6
	11/30/2005	11:04	13.52	6.70	0.180	NM	1.93	15.41	-56.9
	12/28/2005	10:08	14.25	7.12	0.313	0.020	4.44	14.50	181.8
LW-34S	6/7/2005	11:35	15.55	5.61	0.689		0.62	14.27	59.7
	7/22/2005	9:08	14.85	6.62	0.395		1.39	15.03	31.1
	8/30/2005	11:37	14.25	6.50	0.407	0.266	0.24	15.96	-27.3
	10/3/2005	12:07	14.58	6.74	0.430	0.280	0.10	15.70	-28.2
	10/26/2005	12:41	13.91	6.79	0.448	0.291	0.13	16.17	-31.6
	11/30/2005	9:30	14.70	6.36	0.283	NM	1.90	15.83	-19.2
	12/28/2005	8:28	15.39	7.18	0.631	0.041	1.88	16.06	214.3
LW-41S	6/7/2005	14:52	10.80	6.46	0.829		0.31	13.70	-118.2
	7/22/2005	11:48	9.85	6.44	0.906		0.73	14.47	-112.3
	8/30/2005	13:27	8.75	6.59	0.337	0.218	1.30	14.34	-73.4
	10/3/2005	13:44	Dry	NM	NM	NM	NM	NM	NM
	10/26/2005	13:36	Dry	NM	NM	NM	NM	NM	NM
	11/30/2005	10:35	9.66	6.46	0.147	NM	4.71	14.85	-53.0
	12/28/2005	9:37	10.22	7.06	0.588	0.038	0.63	14.73	-66.1
LW-42S	6/7/2005	14:46	12.57	6.37	1.126		0.12	13.54	-134.9
	7/22/2005	11:41	12.16	6.36	0.772		0.57	14.30	-137.0
	8/30/2005	13:23	11.77	6.56	0.650	0.422	0.11	14.73	-135.5
	10/3/2005	13:37	12.10	6.35	0.651	0.423	0.27	15.30	-68.9
	10/26/2005	13:26	11.77	6.47	0.704	0.458	0.20	13.08	-47.6
	11/30/2005	10:19	12.13	6.40	0.469	NM	0.34	15.65	-137.6
	12/28/2005	9:25	12.47	6.55	0.910	0.059	0.60	15.47	-9.6
LW-43S	6/7/2005	14:06	13.59	6.61	1.099		0.09	13.74	-146.0
	7/22/2005	10:01	12.98	6.47	0.613		0.86	14.18	-135.2
	8/30/2005	12:13	12.54	6.56	0.698	0.454	0.23	13.59	-134.2
	10/3/2005	12:26	12.48	6.47	0.688	0.447	0.09	15.06	-72.0
	10/26/2005	13:53	12.26	6.74	0.650	0.422	0.10	15.36	-54.2
	11/30/2005	10:54	12.92	6.57	0.497	NM	0.54	15.32	-158.6
	12/28/2005	9:57	13.49	6.80	0.961	0.063	0.20	15.17	-16.9
LW-44S	6/7/2005	14:13	14.96	6.44	1.092		0.24	13.73	-138.2
	7/22/2005	10:13	14.27	6.45	0.912		0.37	14.40	-160.5
	8/30/2005	12:07	13.72	6.52	0.875	0.570	0.13	13.94	-162.2
	10/3/2005	12:16	14.03	6.35	0.862	0.561	0.13	15.43	67.9
	10/26/2005	13:42	13.43	6.40	0.812	0.567	0.13	16.20	-54.4
	11/30/2005	10:45	14.19	6.47	0.885	NM	0.35	16.00	-181.6
	12/28/2005	9:44	14.96	6.41	0.666	0.043	0.52	15.14	35.2

Notes:

NM = Parameter not measured for this well during this sampling event.

TABLE A-2
SULFATE AND NITRATE CONCENTRATIONS FOR SELECTED WELLS,
FEBRUARY AND AUGUST 2005
TIME OIL NORTHWEST TERMINAL
PORTLAND, OREGON

Location	Lab ID	Date Collected	Sulfate (ug/L)	Nitrate (ug/L)
D	P5H0853-07	08/19/2005	11100	100 U
D	0502102-05	02/23/2005	2510	30 U
LW001S	P5H0814-01	08/18/2005	6580	910
LW001S	0502099-01	02/22/2006	7340	328
LW022D	P5H0625-06	08/15/2005	7060	100 U
LW022D	0502099-04	02/22/2005	2840	218
LW036D	P5H0734-08	08/17/2005	1880	100 U
LW036D	0502088-01	02/17/2005	3740	321
N	P5H0852-01	08/19/2005	1000 U	100 U
N	0502110-01	02/24/2005	500 U	30 U
P	P5H1000-15	08/24/2005	1000 U	100 U
P	0502110-02	02/24/2005	500 U	30 U
Q	P5H1000-16	08/24/2005	1000 U	100 U
Q	0502110-03	02/24/2005	500 U	30 U

U = The analyte was not detected above the given reporting limit.

Fate and Transport Model Results

Facility Name: Time Oil Northwest Terminal
 Site Name:
 Additional Description: LW-021S as source zone

Length: feet
 Time: days
 Mass: pounds

Hydrogeologic Data and Contaminant Transport Calculations

	Maximum	Average	Minimum	NAPL Source	
Hydr. Conductivity [ft/d]	156.0	82.3	44.0	NAPL Source Length [ft]	50.0
Hydraulic Gradient [ft/ft]	0.0158	0.009	0.0014	NAPL Source Width [ft]	50.0
Total Porosity [-]		0.4		Contaminated Aquifer Thickness [ft]	4.6
Effective Porosity [-]		0.3			
Groundwater Vel. [ft/d]	8.216	2.469	0.205		

Contaminant Source Specifications

Source Component	Conc Profile	NAPL Constituent
Total BTEX	True	True
Benzene	True	True
Toluene	True	True
Ethylbenzene	True	True
Xylene	True	True
Naphthalene	True	True
Other Aromatics	False	True
Aliphatics	False	True

Dispersion Parameters

Estimated Plume Length [ft]	406.0
Longitudinal Dispersivity [ft]	16.19
Dispersivity Ratio [-]	20.0
Transverse Dispersivity [ft]	0.81

Sorption Parameters

Fraction Org. Carbon [-]	
Maximum	0.0065
Average	0.001
Minimum	0.0008

	Total BTEX	Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene	
Koc [L/kg]	300	83	300	1100	830	1300	
Retardation Factor [-]							
Maximum	11.34	3.86	11.34	38.9	29.59	45.79	
Average	2.59	1.44	2.59	6.83	5.4	7.89	
Minimum	2.34	1.37	2.34	5.9	4.7	6.79	
Contaminant Concentration Profiles (8/21/2005)							
	Distance	Total BTEX	Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene
Well Name	[ft]	[µg/L]	[µg/L]	[µg/L]	[µg/L]	[µg/L]	[µg/L]
LW-21S	0	2612000.	1750000.	535000.	152000.	175000.	31700.
N	174	3902.	419.	107.	898.	2478.	91.2
P	196.5	2859.2	2780.	BD	BD	79.2	BD
Q	220	741.2	706.	13.9	7.1	14.2	BD
LW-22D	347.5	BD	BD	BD	BD	BD	BD
LW-36D	439.5	BD	BD	BD	BD	BD	BD
Redox Indicator Concentration Profiles (8/21/2005)							
	Distance	Oxygen	Nitrate	Iron(II)	Sulfate	Redox	
Well Name	[ft]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	Condition	
N	174	0.17	BD	NS	BD	SO4/CO2-red.	
P	196.5	0.08	BD	NS	BD	SO4/CO2-red.	
Q	220	0.06	BD	NS	BD	SO4/CO2-red.	
LW-22D	347.5	0.14	BD	NS	7.06	SO4/CO2-red.	
LW-36D	439.5	0.13	BD	NS	1.88	SO4/CO2-red.	
Attenuation Rates							
	Total BTEX	Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene	
NAC (Single Zone) [1/ft]	0.0355	0.0356	0.0481	0.0286	0.038	0.0328	
Decay Rate [1/d]							
Maximum	0.459	0.4617	0.703	0.3445	0.5035	0.4123	
Average	0.1379	0.1388	0.2113	0.1035	0.1513	0.1239	
Minimum	0.0115	0.0115	0.0176	0.0086	0.0126	0.0103	
Time of Stabilization(TOS) and Max Source Conc. Calculations							

Distance to POC [ft]		439.5								
Contaminant	RCC	Well	Source Reduction		Time of Stabilization [years]			Time to Equilibrium		
	[µg/L]		Conc [µg/L]		Breakthrough Time			Average		
			Current	Target	Maximum	Average	Minimum	Maximum	Average	Minimum
Total BTEX	50000.0	1	2612000	No Reduction Required						
Benzene	5.1	1	1750000	No Reduction Required						
Toluene	9.8	1	535000	No Reduction Required						
Ethylbenzene	7.3	1	152000	No Reduction Required						
Xylene	13.0	1	175000	No Reduction Required						
Naphthalene	0.2	1	31700	No Reduction Required						
Time of Remediation(TOR) Calculations										
NAPL Component	Mass Fraction[-]	Solubility [mg/L]	Molecular Wght[g/mole]							
Total BTEX	0.00	0.0	0.0							
Benzene	0.01	1750.0	78.1							
Toluene	0.08	535.0	92.1							
Ethylbenzene	0.05	152.0	106.2							
Xylene	0.12	175.0	106.2							
Naphthalene	0.01	31.7	128.2							

Facility Name: Time Oil Northwest Terminal
 Site Name:
 Additional Description: N as source zone

Length: feet
 Time: days
 Mass: pounds

Hydrogeologic Data and Contaminant Transport Calculations

	Maximum	Average	Minimum		NAPL Source
Hydr. Conductivity [ft/d]	156.0	82.3	44.0	NAPL Source Length [ft]	50.0
Hydraulic Gradient [ft/ft]	0.0158	0.009	0.0014	NAPL Source Width [ft]	50.0
Total Porosity [-]		0.4		Contaminated Aquifer Thickness [ft]	2.3
Effective Porosity [-]		0.3			
Groundwater Vel. [ft/d]	8.216	2.469	0.205		

Contaminant Source Specifications

Source Component	Conc Profile	NAPL Constituent
Total BTEX	True	True
Benzene	True	True
Toluene	True	True
Ethylbenzene	True	True
Xylene	True	True
Naphthalene	True	True
Other Aromatics	False	True
Aliphatics	False	True

Dispersion Parameters

Estimated Plume Length [ft]	232.7
Longitudinal Dispersivity [ft]	12.04
Dispersivity Ratio [-]	20.0
Transverse Dispersivity [ft]	0.60

Sorption Parameters

Fraction Org. Carbon [-]	
Maximum	0.0065
Average	0.001
Minimum	0.0008

	Total BTEX	Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene
Koc [L/kg]	300	83	300	1100	830	1300
Retardation Factor [-]						
Maximum	11.34	3.86	11.34	38.9	29.59	45.79
Average	2.59	1.44	2.59	6.83	5.4	7.89
Minimum	2.34	1.37	2.34	5.9	4.7	6.79

Contaminant Concentration Profiles (8/21/2005)

	Distance	Total BTEX	Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene
Well Name	[ft]	[µg/L]	[µg/L]	[µg/L]	[µg/L]	[µg/L]	[µg/L]
N	0	3902.	419.	107.	898.	2478.	91.2
P	22.5	2861.2	2780.	1.	1.	79.2	2.
Q	46	741.2	706.	13.9	7.1	14.2	BD
LW-22D	173.5	BD	BD	BD	BD	BD	BD
LW-36D	265.5	BD	BD	BD	BD	BD	BD

Redox Indicator Concentration Profiles (8/21/2005)

	Distance	Oxygen	Nitrate	Iron(II)	Sulfate	Redox
Well Name	[ft]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	Condition
N	0	0.17	BD	NS	BD	SO4/CO2-red.
P	22.5	0.08	BD	NS	BD	SO4/CO2-red.
Q	46	0.06	BD	NS	BD	SO4/CO2-red.
LW-22D	173.5	0.14	BD	NS	7.06	SO4/CO2-red.
LW-36D	265.5	0.13	BD	NS	1.88	SO4/CO2-red.

Attenuation Rates

	Total BTEX	Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene
NAC (Single Zone) [1/ft]	0.0362	0.0583	0.0432	0.1038	0.1119	0.1698
Decay Rate [1/d]						
Maximum	0.4278	0.8149	0.5394	1.9185	2.158	4.2453
Average	0.1285	0.2449	0.1621	0.5765	0.6485	1.2758
Minimum	0.0107	0.0204	0.0135	0.0479	0.0539	0.1061

Time of Stabilization(TOS) and Max Source Conc. Calculations

Distance to POC [ft] 265.5

Contaminant	RCC [µg/L]	Well	Source Reduction		Time of Stabilization [years]			Time to Equilibrium		
			Conc [µg/L]		Breakthrough Time			Time to Equilibrium		
			Current	Target	Maximum	Average	Minimum	Maximum	Average	Minimum
Total BTEX	1.0	1	3902	No Reduction Required						
Benzene	5.1	2	2780	No Reduction Required						
Toluene	9.8	1	107	No Reduction Required						
Ethylbenzene	7.3	1	898	No Reduction Required						
Xylene	13.0	1	2478	No Reduction Required						
Naphthalene	0.2	1	91	No Reduction Required						

Time of Remediation (TOR) Calculations

NAPL Component	Mass	Solubility	Molecular
	Fraction[-]	[mg/L]	Wght[g/mole]
Total BTEX	0.00	0.0	0.0
Benzene	0.01	1750.0	78.1
Toluene	0.08	535.0	92.1
Ethylbenzene	0.05	152.0	106.2
Xylene	0.12	175.0	106.2
Naphthalene	0.01	31.7	128.2